The social contexts of youth settings for influencing physical activity

by

Chelsey R. Schlechter

B.S., South Dakota State University, 2013
M.P.H., Kansas State University, 2015

AN ABSTRACT OF A DISSERTATION

submitted in partial fulfillment of the requirements for the degree

DOCTOR OF PHILOSOPHY

Department of Kinesiology
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Abstract

Despite health benefits of physical activity (PA) in youth, worldwide objective estimates indicate less than 10% of children meet recommended PA guidelines of 60 minutes of moderate-to-vigorous physical activity (MVPA) per day.[1,2] The places where children go to live, learn, and play influence the amount of PA children accrue,[3,4] therefore, purpose of this dissertation was to examine social contexts of youth settings and describe contextual influences on youth PA.

Chapters one and two address the methods of direct observation (DO) used to characterize contextual influences on youth PA. Chapter 1 serves as a review of the methods of current DO systems, and Chapter 2 describes the implications of using different methods to characterize contexts and PA in youth settings. Using youth sport (YS) as an example, we examined the distinct types of data that resulted from two DO systems, and discussed implications for describing influences of children's PA.

Little is known about the distribution of PA among children within setting time, such as whether social contexts promote inequalities in PA where some children are very active and others are inactive. Therefore, the purpose of the study in Chapter 3 was to describe the distribution of PA during time segmented YS practices and identify whether inequalities in PA exist. We hypothesized that inequality would vary between time segments of different contexts, specifically, that segments that fostered inclusion (i.e., optimal demand) would have lower inequality than segments that fostered exclusion (i.e., disadvantaged demand). We found that inequality in PA was varied between segment types and that social contexts of task (i.e., purpose of the segment time) and demand influenced inequality in PA. To create improvements in child population PA, we propose researchers and practitioners should focus not only on the mean PA of setting time, but also on the distribution of PA within setting time.

Chapter 4 focuses on the social structure of relationships within a school district that may influence implementation of wellness policies within school systems. The study described a method and investigated the social structure between school district wellness committees and their associated elementary schools. Results of the study showed variability in the pattern of social structure between and within school districts, with some districts having a social structure with representation of schools on the district wellness committee, and other districts with no representation. As social structure characteristics influence the implementation of policies and

practices within social systems, these characteristics should be investigated by researchers, and should be used to enhance implementation, rather than be disregarded.

In conclusion, this dissertation provided recommendations for describing the social contexts of youth settings, provided preliminary evidence that social contexts influence the amount and distribution of PA within youth settings, and that social contexts are highly variable within and between settings. Further research is needed to find the combination of social contexts most conducive to youth PA, and future researchers should consider social contexts when designing and implementing interventions for improving youth PA within settings.

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Dedication

I dedicate this dissertation to my nieces and nephews.

You are all so smart, talented, and feisty.

I hope you find your passion,

you fail fast,

you explore,

and most of all,

you keep your fire.

Dissertation Introduction

Physical activity (PA) has numerous health benefits for youth,[1,2] including improved body composition,[2] bone density,[2] and psychosocial outcomes.[1] Physical activity behaviors in youth have been shown to track to adulthood,[3,4] therefore increasing PA in youth may decrease risk for cardiovascular,[1,5] metabolic diseases,[1] and many cancers[6] in adulthood. Despite health benefits, worldwide estimates indicate that less than 10% of boys and 2% of girls aged 5-17 years meet recommended PA guidelines[7] of accruing 60 minutes of moderate-to-vigorous physical activity (MVPA) per day.[8]

The places where children live, learn, and play can provide opportunities for and restrict children's PA. Within each place are a variety of elements, including physical and social contexts, that influence children's PA during setting time. Currently, most setting-based observation systems are designed to capture estimates of PA and context of youth settings as an average for the total setting time (e.g., total sport practice time). Though describing activity and contexts during total setting time is useful, averaging PA and contexts across the entire setting duration does not allow researchers to examine the pattern of variability in PA that occurs within youth setting time, or to examine contexts that may be driving low activity during youth setting time. Despite advances in PA assessment to provide time-stamped objective data, the processes that influence children's PA within youth setting time remain relatively unknown. Though multiple evidence-based practices exist for improving PA at youth settings, examining PA and context within setting time may provide additional insight to further understand and improve youth PA within settings.

Policy makers, practitioners, and researchers frequently take a place-based approach to modify the physical and social environments of youth settings to be more conducive to youth health behaviors. Improvements in health behaviors within these settings are largely dependent on whether or not practice changes to improve setting environments are actually implemented within the setting.[4–6] Whether a practice change is implemented within a setting is influenced by the existing social structure of the setting where the practice is introduced, suggesting that working with the existing social structure of youth settings is likely to increase implementation,[11,14–16] but there is a gap in the literature as to characteristics of the social structure of youth settings that may influence implementation of healthful practices.

The purpose of this dissertation was to examine social contexts of youth settings and describe contextual influences on youth PA. This dissertation comprises a series of chapters that seek to describe methodological considerations for examining contextual influences on PA in youth settings, and test the influence of social contexts on the amount and distribution of PA within youth settings.

Direct observation (DO) systems are frequently used as a rigorous method to assess contexts and PA of youth settings. Chapter 1 provides a review of methods used in existing DO systems, and Chapter 2 examines the implications of different types of DO methods in describing context and PA in youth settings. Using youth sport as an example, we video coded youth sport practices using two direct observation systems comprised distinct methods, and examined the implications of those methods on the type of data generated by the system.

Youth sport is one setting where children accrue substantial amounts of MVPA, but little is known about the distribution of PA among children within youth sport time, such as whether social structural contexts promote inequalities in PA during practice time. Therefore, the purpose of the study in Chapter 3 was to describe inequality in PA during time-segmented youth sport practices. We hypothesized that inequality would differ between segments of different contexts, specifically, that segments that fostered inclusion (i.e., optimal demand) would have lower inequality than segments that fostered exclusion (i.e., disadvantaged demand).

Previous research has supported numerous evidence-based practices for improving youth PA within settings, however, implementation of these practices into youth settings is difficult to achieve and rarely sustained long-term. Chapter 4 focuses on the social structure of relationships within a school district that may influence implementation of health and wellness policies within school systems. The study in Chapter 4 described a method and investigated the social structure between school district wellness committees and their associated elementary schools.

This dissertation is intended to provide methodological considerations for observing the influence of social contexts on youth PA, build on existing literature of the evidence-based practices for improving youth PA within youth setting time, and describe social structural characteristics of youth settings that may influence implementation of evidence-based practices for improving youth health behaviors.

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Chapter 1 - A Review of Direct Observation Systems for Characterizing Physical Activity and Contexts in Youth Settings

Chelsey R. Schlechter, MPH & David A. Dzewaltowski, PhD

Introduction

The benefits of physical activity (PA) in youth are well established,[1,2] yet worldwide objective estimates indicate that less than 10% of children currently meeting PA guidelines.[3] Understanding the influences on children's PA behavior and developing methods to assess the influences on children's PA remains an important research agenda.[2,4] One approach to understanding children's behavior draws from social-ecological theory,[5,6] where children's behavior is studied as the outcome of multiple individual, social environmental, and physical environmental factors. Researchers have built on this premise to use placed-based approaches to characterize the multiple factors that influence PA in the places where children live, learn, and play.

Each of these places can be considered a dynamic social system, with factors that can afford and constrain children's behavior.[5,7,8] One commonly used set of methods to describe the social and physical environmental factors that influence children's PA in these places is direct observation (DO). Direct observation systems provide a rigorous way to assess contextually rich data on the influences on behavior in real-world settings, while alleviating the burden and subjectivity of self-report instruments. Currently, several DO systems exist that are designed to characterize the contexts that influence youth behavior PA behavior. These systems assess various contextual factors, including social contexts (i.e., aspects of the social environment; social associations, leader behavior, etc.) and physical contexts (i.e., aspects of the physical environment; location, equipment available, etc.), and are comprised a variety of different methods.

Each DO system comprises three key observation methods: 1) the spatial and temporal boundaries, 2) the level of observation, and 3) the sampling methods. Each observation is defined by a spatial and temporal boundary; the spatial boundary defines the physical location and social environment where behavior occurs, and the temporal boundary defines the start and stop of stable state for observation. Within defined temporal and spatial boundaries, the researcher defines whether to characterize PA as the outcome of the individual level, or group level. The sampling method refers to the who or what to record variables of interest on (i.e., focus of observation) or when and how to record variables of interest (i.e., temporal sampling method). Each combination of the above methods results in distinct types of data, and is

therefore appropriate to answer distinct research questions.[9,10] Therefore, researchers conducting DO should choose each observation method based on the research question of interest.

Though multiple resources exist on best practices of direct observation,[9–13] to our knowledge there is no comprehensive summary of existing DO systems for assessing contextual influences on children's PA. Therefore, the purposes of this review were to identify existing DO systems designed to capture contextual influences on youth PA in youth settings; to describe the contexts assessed by each system; and to describe the observation methods used by each system.

Summary of Contexts and Methods of DO systems

Contexts

Twenty DO systems were identified from the literature by hand searching observation systems that were well-known to the co-authors, searching reference lists of observation systems as they were identified, and performing a keyword search in Google scholar. The summary of contexts assessed by DO systems can be found in Table 1-1. A full description of contexts and methods of each observation system is in Appendix A.

Social Environment

Purpose/Task. Most (n = 16)[14–25] DO systems assessed the primary purpose or activity context of the observation sample. Activity contexts were primarily reported as percentage of intervals, percentage of total setting time, and total minutes of setting time spent in each type. In preschools, Brown and colleagues[26] found most intervals of indoor time were spent in transition, snacks and naptimes. Numerous systems also reported variability in activity intensity between activity context types. For example, in the PE setting, McKenzie and colleagues[27] found over 20% of PE lesson time to be spent in fitness activities, and that students expended more energy during fitness intervals than other activity contexts.

Leader/Adult Behavior. Multiple leader practices have been shown to influence the percentage of time children spend active within setting time,[28] and numerous evidence-based practices have been promoted to increase activity during setting time, such as decreasing management time, using small groups and non-elimination games, and eliminating lines.[29,30] Most of the thirteen systems that assessed leader/adult behavior during setting time assessed leader encouragement or discouragement of PA. Two DO systems assessed leader implementation of evidence-based

practices to promote PA during setting time (e.g. CATCH[30], LETUSPLAY[29] principles). Using the System for Observing Staff Promotion of Activity and Nutrition (SOSPAN), Weaver and colleagues[25] found that staff behaviors of playing with children and providing multiple activity choices were associated with associated with positive PA levels in children.[25]

Social Associations. Most (n = 14) observation systems[14,16,17,19–22,24,25,31–35] characterized social associations of youth with peers or adult leaders of the setting. Types of social associations included the arrangement of children within the setting (e.g., small group, whole group, solitary), the size of the group or number of people in the observation area, or individual children's positive or negative interactions with youth or adults. For example, Ridgers and colleagues[20] used the System for Observing Children's Relationships and Activity During Play (SOCARP) to observe school recess time and found that girls spent significantly more time in small groups than boys, and had more occurrences of positive physical interactions than boys.[20]

Physical Environment

Nine observation systems [17,18,25,26,32–34,36,37] characterized aspects of the physical environment, including location (n = 6),[17,25,26,32,33,36] or condition and equipment available in the location (n = 4).[18,34,37]

Physical Activity

Many of the eighteen DO systems[14–23,26,31–37] that were designed to collect PA information as a component of the DO system were modeled after the Children's Activity Rating Scale (CARS).[38] The seven systems[17,19,23,24,26,32,33] that characterized activity type (e.g., crawling, weeding, etc.,) in addition to PA intensity, were primarily in preschool populations, or observed mode specific activities. For example, Myers & Wells[19] developed the Physical Activity Research tool for Garden Observation (PARAGON) to assess garden specific activity motions (e.g., bending, gripping, stretching) in addition to other context variables.[19]

Observation Methods

A summary of DO methods used by each system can be found in Table 2.

Spatial and Temporal Boundary of ObservationAll of the DO systems were designed for place-based observation, including in homes[17,31,32] (n = 3), preschools[23,26,36] (n = 3), schools[31,33,37] (n = 3), PE[16,21,24,35] (n = 4), classrooms[22] (n = 1), recess[20,34], (n =2), sports[14,15] (n = 2), gardens[19] (n = 1) and parks/recreation areas[18] (n =1). Eleven observation systems [14–16,20,21,23–25,34–36] defined the

observation period as total setting time (e.g., total PE class time). Nine observation systems [17–19,22,26,31–33,37] defined the observation period as a researcher-defined block of time within setting time (e.g., 30 minute period of time at home).

Level of Observation

Within defined temporal and spatial boundaries, the researcher defines whether to characterize PA as the outcome of the individual or group. For example, OSRAC[17,26,33] systems characterize PA as the outcome of an individual child. In contrast, SOFIT[35] characterizes PA as the outcome of a group (i.e., PE class).

Sampling Method

The sampling method refers to the who or what to record variables of interest on (i.e., focus of observation) or when and how to record variables of interest (i.e., temporal sampling method).

Focus of Observation. All systems either recorded the variables of interest on a focal child (n = 14) [14–17,19–21,23,24,26,31–33,35] or on a group (n = 6).[18,22,25,34,36,37] Focus of the observation is independent from the level of observation; an observation system could use individual sampling to generate a group outcome. For example, SOFIT[35] uses individual sampling to generate a group level outcome by rotating through a series of randomly selected children during each observation period.[35]

Temporal Sampling. Temporal sampling can be broadly defined in two categories, instantaneous sampling and continuous sampling.[9,10] Using instantaneous sampling, the variables of interest are recorded at pre-determined time intervals (e.g., every 20 seconds). Within instantaneous sampling, researchers commonly use interval sampling, where the behavior or context is recorded if it occurred at any time during the predefined time interval, or momentary time sampling, where the behavior or context of interest is recorded at the very end of the predefined time interval. Most observation systems used interval sampling (n = 5) [22,24,31,32,35] or momentary time sampling (n = 15).[14,15,17–20,23–26,31,33–35,37] In contrast, using continuous sampling, the time interval for recording is defined by naturally occurring start or stop of the variable of interest. The beginning of the time interval is defined as the onset of the behavior or context of interest, the end of the time interval is defined as end of the behavior or context of interest, and the entire duration of the variable of interest is recorded. Only one system used continuous sampling.[16]

Discussion and Considerations

The purpose of this review was to identify existing DO systems designed to capture contextual influences on youth PA in youth settings, describe the contexts assessed by the systems, and describe the observation methods used by each system. Overall, the systems were designed to describe context and PA in a variety of youth settings, assessed multiple physical and social contexts hypothesized to influence youth PA, and used multiple combinations of observation methods.

Many of the DO systems used the same combination of observation methods and assessed similar contexts, but incorporated slight modifications depending on the target setting. For example, the OSRAC systems (i.e., OSRAC-P[26], OSRAC-H[17], OSRAC-E[33], OSRAC-YS[14]) used similar DO methods (i.e., individual level of observation, individual sampling, momentary time sampling) but assessed contexts that were specific to the preschool, home, school, and youth sport setting. Other authors[15,16,19,21,24] credited the popular observation system SOFIT[35] as the rationale for the choice of observation methods for his or her DO system, and used group level of observation, individual sampling, and momentary time sampling.

Of interest was the limited number of observation systems that used continuous sampling to record durations of contexts and behaviors during setting time. Only one observation system (C-SOFIT[16]) recorded duration of contexts, and therefore was the only DO system designed to be able to answer questions including a temporal component, such as the influence of sequence or duration of contexts on youth PA. Most other observation systems used instantaneous sampling, where instances of context and PA were assessed at predetermined time intervals, then, the instances were aggregated to determine the percentage of intervals or percentage of time spent in each activity and context across total setting time. Though useful for describing how total setting time is spent, DO systems using this method are limited from describing the variability that occurs in context and PA within youth setting time.

Previous research in youth settings has demonstrated that children's PA and setting contexts are highly variable within youth setting time[39–43], and that PA is influenced by the contexts of location,[39] task[40] (e.g., purpose; fitness, free play, etc.), arrangement of children within the setting[39] (e.g., whole group, small group, etc.), and whether the setting fostered inclusion or exclusion.[40,44] Understanding the social contexts that influence the pattern of youth PA within youth setting time could provide additional insights into best practices for improving

youth PA within settings. As such, further research using methods appropriate for describing PA and context within setting is warranted.

Most observation systems included DO methods for PA assessment within the DO system; only one observation system was designed to be paired with accelerometry, one of the most widely used methods of PA assessment in youth.[45] Accelerometers provide time-stamped activity measurements which, if incorporated with appropriate DO methods such as continuous sampling, would allow for examination of real-time influences of contexts on PA. Furthermore, use of accelerometers to measure group PA would allow researchers to characterize variability in the distribution of PA among individuals within setting time. Many DO systems assessed a group-level outcome of PA using momentary time sampling to observe an instance of PA on a sample of individuals within the total group. Though this method generates a group level outcome of PA across total setting time, it is not appropriate for describing individual variability in PA within setting time. As technology continues to advance and researchers have access to real-time context and PA data, researchers should consider which type of DO methods are most appropriate to answer his or her research questions.

In conclusion, existing DO systems are comprised a variety of DO methods and assess numerous contexts hypothesized to influence PA. Few DO systems are currently using methods that generate the type of data necessary for real time activity and context assessment, to answer research questions that include a temporal component, or to answer research questions about the distribution of PA within settings. Future researchers using DO should carefully consider his or her research question, and choose the combination of direct observation methods that are most appropriate for generating the type of data that are required to answer the research question.

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Tables and Figures

Table 1-1: Context variables assessed by systems.

	Total % (n)	Systems (reference)	Example
Context			
Social environment			
Purpose/task	80 (16)	[14–21,23–26,33]	Management, free play, self-care
Leader behavior	65 (13)	[14,16,17,19,21,24–26,31,33,34]	Supervise, off task, on task, non-verbal technical behavior, instructs generally
Leader Prompting of PA	55 (11)	[16,17,19,22,24–26,31,33–35]	Promotes PA in class, prompt to decrease PA, prompt to increase PA
Number of children or size of group	15 (3)	[18,20,34]	Number of participants in activity, small, medium, or large group size
Initiator of activity	15 (3)	[17,26,33]	Adult activity initiator, child initiator
Proximity of leader	5 (1)	[14]	Proximal to child, distal to child
Types of child interactions	5 (1)	[20]	Prosocial physical, prosocial nonphysical, ignore
Physical environment			
Location	30 (6)	[17,25,26,32,33,36]	Indoor, outdoor, cafeteria, playground
Equipment available or condition of equipment available	20 (4)	[18,34,37]	Area is accessible, equipment provided by school or other agency
Physical activity			
Included in system	90 (18)	[14–23,26,31–37]	
Paired with other DO system	5 (1)	[25]	
Paired with accelerometer	5 (1)	[24]	
Activity type	35 (7)	[17,19,23,24,26,32,33]	Walking, crawling, weeding, squatting

Table 1-2: Direct observation methods of systems.

	Total % (n)	Systems (reference)	Definition or example
Boundary of observation			
Spatial			
Home	15 (3)	[17,31,32]	Observation occurred throughout the home
Preschool	15 (3)	[23,26,36]	Observation occurred throughout the preschool
School	15 (3)	[31,33,37]	Observation occurred throughout the school
Physical education	20 (4)	[16,21,24,35]	Observation occurred in physical education class
Classroom	5 (1)	[22]	Observation occurred in the classroom
Recess	30 (2)	[20,34]	Observation occurred at the recess area
Youth sport	30 (2)	[14,15]	Observation occurred in the youth sport practice/game area
Garden	5 (1)	[9]	Observation occurred in the garden
Parks/Recreation area	5 (1)	[18]	Observation occurred in a park
Temporal			
Total setting time	55 (11)	[14–16,20,21,23–25,34–36]	Total PE time, total youth sport time
Defined sampling period within setting time	45 (9)	[17–19,22,26,31–33,37]	30 minute period of time at home, 20 minutes during lunch
Level of analysis			
Group	55 (11)	[15,16,18,21–25,34,35,37]	Group level estimates of PA and context
Individual	45 (9)	[14,17,19,20,26,31–33]	Individual estimates of PA and context
Sampling methods			
Focus of observation			
Individual	70 (14)	[14–17,19–21,23,24,26,31–33,35]	Individual child is the focus of the observation
Group	30 (6)	[18,22,25,34,36,37]	Group is the focus of the observation
Temporal Sampling method			
Interval	25 (5)	[22,24,31,32,35]	Occurrence of behavior any time during interval
Momentary time	75 (15)	[14,15,17–20,23–26,31,33–	Occurrence of behavior at the end of the

		[35,37]	interval
Scan sampling without predefined intervals	5 (1)	[36]	Walked around a physical area multiple times within the observation period, but not at a pre-determined time interval
Continuous sampling	5 (1)	[16]	Duration of behavior

Chapter 2 - Implications of Direct Observation Methods for Describing Influences on Children's Physical Activity in Youth Settings

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Introduction

The benefits of physical activity (PA) in youth are well established [1,2] and include improved bone density,[1,2] body composition,[1,2] psychosocial outcomes,[1] and improved academic performance.[1] World-wide accelerometer estimates indicate that less than 10% of youth are meeting PA guidelines of 60 minutes of moderate-to-vigorous physical activity (MVPA) per day.[7] Youth physical activity behaviors[1,2] have been shown to track to adulthood,[3,4] therefore increasing PA in youth is likely to decrease the risk for cardiovascular[1,5] and metabolic[1] diseases, and many cancers[6] in adulthood.[1,5,6] As such, characterizing the processes that influence children's PA remains an important public health research agenda.[1]

Researchers seeking to conduct ecologically valid studies in naturally occurring child development contexts have turned to rigorous direct observation (DO) methods to assess setting contexts and behaviors.[8–13] Using DO methods, researchers can describe contextually rich social and physical environments and PA in a rigorous manner, while removing the subjectivity and burden of self-report from youth or adult leaders of youth settings.[14–16] Researchers of behavior have long proposed that DO systems afford non-destructive methods that enable the researcher to act as a transducer[8] of the phenomena of interest as it naturally exists.[8,14,15] The process of direct observation, therefore, may utilize variety of different methods, that should be carefully chosen based on the phenomena the researcher intends to characterize.[15]

Rather than the tool or established observation system defining the data collected, we propose the research question should provide the rationale for the decisions that define the type of data obtained and the DO method used.[14,15] For researchers studying the influence of child development setting context on PA, we propose that three key methodological decisions must be made. Researchers should choose the following methods based on rationale from the specified research question: 1) the spatial and temporal boundary of the stable context for observation, 2) the level of observation, and 3) the sampling methods.

The Spatial and Temporal Boundary of Observation

The context for observation is defined by spatial and temporal boundaries. A spatial boundary defines the physical location and social environment where behavior occurs. Because the characteristics of social and physical environments are dynamically changing, a temporal boundary defines a stable state of the space for observation. As researchers want to characterize generalizable if-then relationships about the phenomena of study, they need to observe the

context under a stable state. By defining the condition in a stable state, the impact of dynamic changes in the physical and social environment on behavior can be identified. In sum, a state for observation includes stable physical environment or context where there are no changes in physical attributes and a stable social environment or context where there are no changes in the social attributes.

By clearly defining boundaries, researchers define a DO unit for analysis. For example, a researcher may seek to describe PA during the school day. For this research question the stable spatial environment would be a defined school location boundary and a stable social context would be defined by a time period at school, such that the start boundary would be the beginning of the school day, and the end boundary would be the end of the school day. With these boundaries defined, researchers can describe variability across total school time or between school day types. However, if the researcher wishes to describe variability *within* the school day, such as whether children were more active during recess or physical education (PE) time, the boundary of the stable physical location would need to be defined as the gym or playground and stable social context would need to change from the start and end time of the school day, to the start and end time of PE and recess. Direct observation systems have frequently been used to describe PA in youth settings such as PE,[17–21] recess,[22] youth sport,[10,23–25] and after school programs,[26–30] where the start and end boundaries are the naturally occurring beginning and end of the class, recess, or program time. Similarly, by defining the stable social context as total class, recess, or program time, researchers can characterize variability across total class, recess, or program time, but not variability *within* that time. For example, a researcher may seek to determine whether structured time during an after-school program has more activity than unstructured, free-play time during the after-school program.[28] To answer this research question, the boundary of the stable social context would be defined by the start and end times of the structured and unstructured activities.

Level of Observation

Within the defined spatial and temporal boundaries, direct observation systems can be designed to characterize context and PA as an individual level outcome or as a group level outcome. For example, the researcher may wish to characterize contextual influences on PA for an individual child in the home setting. For this research question, the researcher would use methods appropriate for an individual level of observation, such as individual sampling[14,15] (described

below). In contrast, a researcher may wish to characterize context and PA of all children on a playground. For this research question, the researcher would use methods appropriate to study the group as the level of observation, such as group sampling[14,15] (described below).

Sampling

Focus of Observation. Within each level of analysis, DO systems can use different methods for who or what to observe as the focus of the observation. Direct observation systems frequently use individual (child) sampling, where the observer records variables of interest for an individual,[10,13,31] or group sampling, where the observer records variables of interest for a group.[23,26–28,32,33] The focus of the observation is distinct from the level of observation; an observation system could use individual sampling to generate a group level outcome by rotating through a series of children during the observation period.[13–15]

Temporal Sampling. Temporal sampling, also referred to as time sampling and time recording, refers to how and when to record behaviors of interest.[14,15,34] Two types of frequently used temporal sampling methods are instantaneous sampling and continuous sampling.[14,15] Using the method of instantaneous sampling, the observer records the variable of interest at pre-defined time intervals (e.g., every 20 seconds), then the observer aggregates the pre-determined time intervals to determine number of intervals or percentage of total time spent in behavior (e.g., PA) and contexts.[13–15] Instantaneous sampling can be used to determine relative frequencies of behavior and contexts in order to determine activity time budgets (i.e., percentage of total time or minutes spent in an activity and context), but does not permit examination of absolute frequency, duration, or sequence.[14,15] Using continuous sampling, the observer records the variable of interest for the entire duration of the occurrence. The start time of the interval is determined by the onset of the behavior or context of interest, and the end time of the interval is determined by the end of the behavior or context. Unlike instantaneous sampling, the time interval length is not determined a priori by the observer but is defined by the naturally occurring start and stop point of the variable of interest. Continuous sampling can be used for calculating absolute frequencies, durations, and sequence of behaviors and contexts.[14,15]

Researchers can use DO systems comprised multiple combinations of the methods described above to answer his or her specified research questions. Currently, most setting-based observation systems are designed to capture children's PA and context at the entire setting duration (e.g., youth sport practice), and use instantaneous sampling to assess instances of a PA

and context on an individual.[16] Those instances are then averaged for percentage of total setting time spent in various contexts and PA. Though these DO systems are useful in providing valuable information as to how setting time is spent, describe day to day or setting to setting variability in PA and context, the DO systems are not well suited to describe variability in PA and context *within* setting time and therefore are restricted from describing the influences on children's PA within setting time.

Research conducted in youth settings has shown that children's pattern of PA is highly variable within youth setting time. But, despite advances in PA assessment to provide time-stamped accelerometer data, the processes that influence children's PA within youth setting time remains relatively unknown. In each youth setting, multiple individual, physical, and social environmental processes influence the outcome of children's behavior across time.[12,35] To characterize these processes requires appropriate methods that are non-destructive to the process as it naturally exists.[8] Therefore, the purpose of this study was to describe the implications of using different methods of direct observation to characterize context and children's PA in youth settings. Using youth sport as an example, we examined the types of data that result from two DO systems comprised distinct methods, and discuss implications for describing influences on children's PA.

Methods

The protocol for this project was approved by the Kansas State University Institutional Review Board #7855. Data were collected during the winter of 2016 and early spring of 2017.

Setting

Recreation youth boys' and girls' basketball teams were recruited from the parks and recreation department of Midwestern city in the United States (population >50,000). Each team practiced 2 times/week, played 1 game/week, and was coached by a volunteer. Coaches (n = 28) of 7-12 year-old girls and boys teams were invited to participate, of which 16 coaches volunteered for participation. Three teams were excluded from analysis for low numbers at practice and 1 team was excluded for equipment malfunction. Twelve teams (boys = 6) were included in the final analysis.

Participants

Coach and child characteristics are listed in Table 1. All children (n = 119, boys = 58.8%) from consenting coaches were eligible to participate. Children were excluded from the

study if 1) he or she did not have parental consent or 2) did not attend practice on an observation day. Ninety-three children met inclusion criteria and were included in analysis.

Measures

Video Observation. Youth sport practices were recorded using the video capability of two Apple™ iPod Touch 5th Generation (California, USA) fitted with wide-angle lenses. One camera was fitted to a tripod and positioned to record the entire practice area, and the other was worn as a belt camera around the waist of the coach.

Direct Observation Systems.

System 1: The methods of System 1 were 1) define the boundary of the social context as total youth sport practice time 2) use a group level of observation, and 3) use instantaneous sampling of individuals. System 1 followed the protocol for The System for Observing Fitness Instruction Time[13], an observation system widely used in youth settings to assess children's physical activity, lesson context, and leader promotion of activity. For more information on SOFIT, see McKenzie et al.,.[17,18,36] The system used two types of instantaneous sampling: 1) momentary time sampling with 10-second observe, 10-second record intervals to record lesson context and PA, and 2) partial interval sampling to document whether the leader promotes physical activity in-class or out-of-class at any time during the interval. At the beginning of each observation, observers randomly selected 5 focal children (4 and 1 alternate) to be observed. Starting with child 1, each child was observed for 4 consecutive minutes (12 observe/record intervals) on a repeated cycle for the entire duration of the observation. After observation completion, all intervals were summed and the percentage of time spent in each activity type and context for the total setting duration were calculated as the ratio of intervals of each type to total observed intervals (i.e., observed intervals/total intervals).

System 2. The methods for System 2 were to 1) define the boundary of the social context as continuous context (e.g. task; goal of the time period) within youth sport practice time, 2) use group level of observation, 3) use continuous sampling of the group. For more information on System 2, see Dzewaltowski & Schlechter.[46] The system observed the youth sport team as a group and divided practice time into continuous context time segments with start and stop boundaries determined by naturally occurring changes in context (e.g., task; the purpose of the time segment) within setting time. Task (i.e., the goal of the time segment; free-play, management, warmup, etc.), participant arrangement (i.e., arrangement of members of the group;

whole group, small group, solitary, etc.), and participant demand (i.e., the distribution of participants within the time segment; equal number of opportunities to participate as children available to participate, fewer number of opportunities available to participate as children available to participate) were assessed for each time segment. Frequency, duration, and percentage of time spent in activity intensities (as assessed by accelerometry) were calculated for each time segment type.

Physical Activity. Physical activity was assessed 1) from direct observation using System [13] and 2) from Actigraph GT1M accelerometers. Physical activity assessment from System 1 (i.e., SOFIT) methodology has been validated with heart rate monitoring and accelerometer assessment.[13,19] Accelerometers have been shown to be a valid and reliable measure of PA in youth[37] and Actigraph accelerometers are the most widely used accelerometer in PA research.[38] Accelerometers were initialized to 15-second epochs and worn on the right hip of consenting children.[39] Evenson cut-points (2008) were used to determine time spent in MVPA (≥ 2296CPM).[39] Evenson cut-points have been shown to be the most accurate estimation of MVPA for our target age group.[37]

Procedures

Research assistants (RAs) attended a meeting with potential coaches hosted by the local parks and recreation department to provide information and recruit coaches to the project. After coaches consented for participation, RAs attended three practices per team for data collection. At the first, practice research assistants familiarized coaches, parents, and children with the accelerometer and video equipment, and collected parent demographic surveys and consent. At the second and third practice, RAs collected video and accelerometer data. Upon arrival to the practice location, RAs set up the tripod camera and fitted coaches with the wearable camera. Research assistants placed accelerometers on the right hip of children with parental consent as the children arrived at practice, and removed accelerometers upon practice completion. Video start and stop times, and accelerometer on and off times were recorded using a universally synced clock.

Video Coding. Each practice was video coded using the two observation systems. Four RAs conducted all video coding; two RAs were assigned exclusively to each system. Each RA was trained extensively on his or her respective observation system and demonstrated reliability (>80%) to a gold standard. For each observation system, each RA independently coded 50% of

the practices. For a subset of practices (n = 5 per system), both RAs independently coded the practices, then met to check inter-rater reliability. Inter-rater reliability was >85% for both observation systems.

Data Reduction. Raw accelerometer counts were exported into a Microsoft Excel file using Actigraph software. Using a SAS macro developed the authors, Evenson cut-points (2008) were applied to 15-second epochs to determine time spent in MVPA [39]. Then, time-stamped accelerometer data were paired with time-stamped start and stop points of continuous context time segments derived from video observation.

Statistical Analysis

All statistical analysis was conducted in SAS (Version 9.4M5; Cary, NC, USA). Descriptive statistics were calculated for teams, children, and time segment characteristics. Frequency and percentage of intervals spent in each context and activity type, percentage of intervals spent in MVPA within each context, and percentage of intervals that contained PA promotion were calculated from System 1 observation data. Frequency and duration of segment types, and percentage of time spent in PA within segments were calculated from System 2 observation data.

Results

System 1

Percentage of total practice time spent in lesson context and percentage of intervals in MVPA within lesson context are presented in Table 2. Across all practices, over half of practice time was spent in MVPA (mean, 95% CI = 64.39%, 59.58–69.21). Most intervals had no occurrence of PA promotion (mean, 95% CI = 65.5%, 59.4−71.4) or in practice promotion (mean, 95% CI = 34.4%, 28.5−40.4).

System 2

Across all practices, RAs identified 256 time segments with an average of 11 segments per practice (mean = 10.66, SD = 2.46). Segment characteristics and percentage of time spent in MVPA within segment types is presented in Table 3.

Discussion

The purpose of this study was to describe the implications of methods of direct observation to characterize influences on children's PA in youth settings. The two DO systems

used in this study comprised distinct methods and thus resulted in distinct types of data. The methods of System 1 generated data that characterized PA and context during the total practice time. Across all practices, over half of practice time was spent in MVPA (64%). Almost half of total practice time was spent in skill practice (47%), with 68% of all skill intervals spent in MVPA. In contrast, the System 2 generated data that characterized PA and context within practice time by dividing time into continuous context time segments. Approximately 11 segments occurred per practice and skill practice was the most frequently occurring segment type with an average duration of ~5 minutes per segment and ~37% of segment time spent in MVPA.

System 1 (i.e., SOFIT) has been used extensively in youth PA research to describe the percentage of time spent in activity during PE[17,18,40], scouting[41], after-school[29], and youth sport.[24] The system is well suited for describing variability during total setting time, but, due to the methodology of the system, is restricted from examining variability of PA and context within setting time. As depicted in Figure 1: A, children's activity is highly variable across youth sport practice time, where some periods of time are highly active, and others have little activity. System 1 defined the boundary of the stable context as total practice time and used momentary time sampling to assesses instances of behavior of an individual (Figure 1: A). These instances were aggregated across total practice time to generate a group level of outcome of PA and context. Therefore, PA and context data generated from System 1 were reported as an average percentage of time spent in activity and contexts across total practice time (Figure 1:B).

Averaging PA across total setting time masks the variability in PA that occurs across time so that periods of low activity cannot be distinguished from those with high activity. Furthermore, these methods restrict the system from describing the changes in context that occur across time, or answer research questions involving a temporal component such as the relationship between sequence or duration of contexts that occur across practice time with PA.[14,15] Identifying the time periods of low activity and the contexts influencing PA during those time periods is important to help identify strategies to modify youth sport practices to increase PA across total practice time.

In contrast to System 1, System 2 defined the boundary of the stable context by a continuous task context within practice time (Figure 1:A). Therefore, System 2 described the variability in context and PA that occurred across within youth sport practice (Figure 2: B) by dividing total practice time into smaller time segments defined by a change in context.

The system used continuous sampling to follow the entire youth sport team as the focus of observation, and therefore we could match time-stamped context data with every child's time-stamped accelerometer data. Pairing time stamped context data with time stamped activity data allows researchers to describe in real-time the processes that may be driving low activity during sport time.[42]

Previous research using methods similar to System 2 has shown that context and PA is highly variable within youth setting time, and is influenced by task[23,27,28,32] (e.g., fitness, free play), member arrangement of children[32] (e.g., whole group, small group, etc.), location[27,32,43] (i.e., indoor, outdoor), and demand[23,44] (i.e., whether the setting fosters inclusion or exclusion) of the time segment. For example, Trost et al., (2008) described time segments that occurred in the after-school setting and found that free play time segments had significantly more time in MVPA than organized PA time segments.[28] In child care, segments organized in small group activities were shown to have greater percentage of time spent in total physical activity than segments structured in whole group activities, and segments spent outdoors were significantly more active than segments spent indoors.[32,43] In youth summer camp time[44] and youth sport practice time[23], segments structured to foster inclusion (i.e., optimal demand; non-elimination games, no children waiting in lines) have been shown to have greater percentage of time spent in MVPA than segments structured to foster exclusion (i.e., disadvantaged demand; elimination games, children waiting in lines). Additionally, though not presented in this paper, with data generated from these methods researchers could answer research questions such as the influence of frequency, sequence, and duration of segment types on youth PA.

As described above, DO systems can use a combination of methods to answer a specified research question. We propose that researchers should not define his or her research question based on limitations of the methods of an observation system, but rather use the combination of methods that are most appropriate for the phenomena the researcher wishes to characterize. For example, Coleman and colleagues (2008) used a combination of the methods found in Systems 1 and 2 of the current study to characterize healthy eating and PA in after-school program time. The observation team used continuous sampling to divide setting time into time segments based on a change in context (i.e., academic, enrichment, recreational, snack).[26] Then, for each active recreation time segment, the researchers used momentary time sampling to describe context, PA, and leader promotion of activity active recreation time.[26]

Due to the different methods of the two DO systems highlighted in this paper, comparison of results between the two systems should be made cautiously. In addition to differences in boundary of the stable context and sampling methods, the observation systems used different operational definitions for the 'lesson context' and 'task' codes. For example, the System 2 included a 'task' code for warm-up, which would likely be coded as the lesson context 'fitness' or 'skill practice' using System 1.[13] Additionally, the two systems used different methods to assess PA. Though both accelerometers and direct observation have been shown to be valid and reliable estimates of PA, direct observation may overestimate MVPA compared to accelerometers.[45]

Few other studies have assessed context and PA in the youth sport setting. Guagliano and colleagues (2013) used SOFIT to describe context during girls' basketball practices and found similar percentages of total practice time spent in skill practice (51%, 47%) and fitness (3%, 4%) to the present study.[24] Cohen and colleagues (2014) used the Observation System for Recording Activity in Children: Youth Sports (OSRAC-YS), a system that uses similar methods but different operational definitions of context as SOFIT, also found high percentages of total practice time spent in drills (46%) and low percentage of total time spent in fitness (2%).[10] To our knowledge only one other study has examined context and PA in youth sport using continuous sampling. In youth flag football practices, Schlechter et al., (2018) found that an average of 7 segments occurred per youth sport practice, and similar to the present study, sport skill segment types occurred most frequently, and had similar percentages of time spent in MVPA (31%, 37%).[23] Future research should continue to examine context and PA within youth sport time to understand the types of segments that are most conducive to PA during sport time, without compromising other outcomes of youth sport, such as skill development.

The present study is not without limitations. We examined only basketball teams from a limited age range (7–12 years) in one Midwestern town, therefore, generalizability of results to other sport types, other age groups, and other regions may be limited. Furthermore, DO systems can comprise multiple distinct methods, and this study provided an example of only a limited combination of those methods. In contrast, the study has several strengths. By using video observation, research assistants could code youth sport practices with two distinct observation systems, each of which had high inter-rater reliability. In addition, the study used two objective

methods of PA assessment (i.e., direct observation and accelerometry) to characterize PA during youth sport practice time.

In conclusion, DO systems can comprise a variety of methods, each of which result in distinct types of data. When using DO systems, researchers should choose methods appropriate for the phenomena that he or she wishes to characterize. As children's activity is highly variable within youth setting time, to further understand how to increase children's activity future research should use methods appropriate to study the influences of children's activity within youth setting time.

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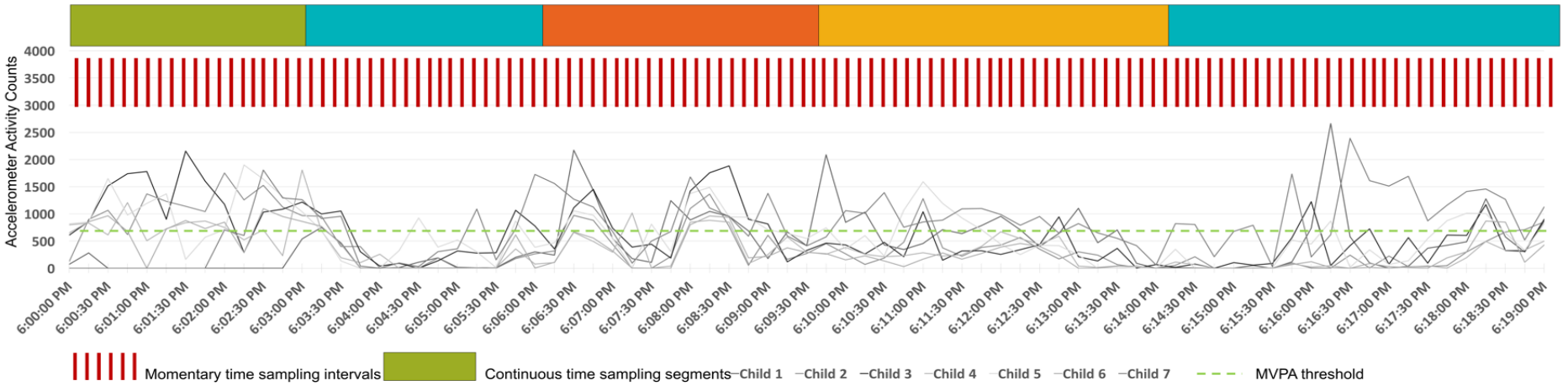
Figure 2-1: Children's physical activity during a sample of one youth sport practice

(**A**) The two observation systems used distinct methods. The System 1 used momentary time sampling to assess PA and context at pre-determined time intervals. System 2 used continuous sampling to divide total practice time into shorter time segments.



(**B**) The two observation systems resulted in distinct types of data. The System 1 characterized PA across total practice time. The System 2 characterized PA within practice time during time segments defined by continuous 'task' context.

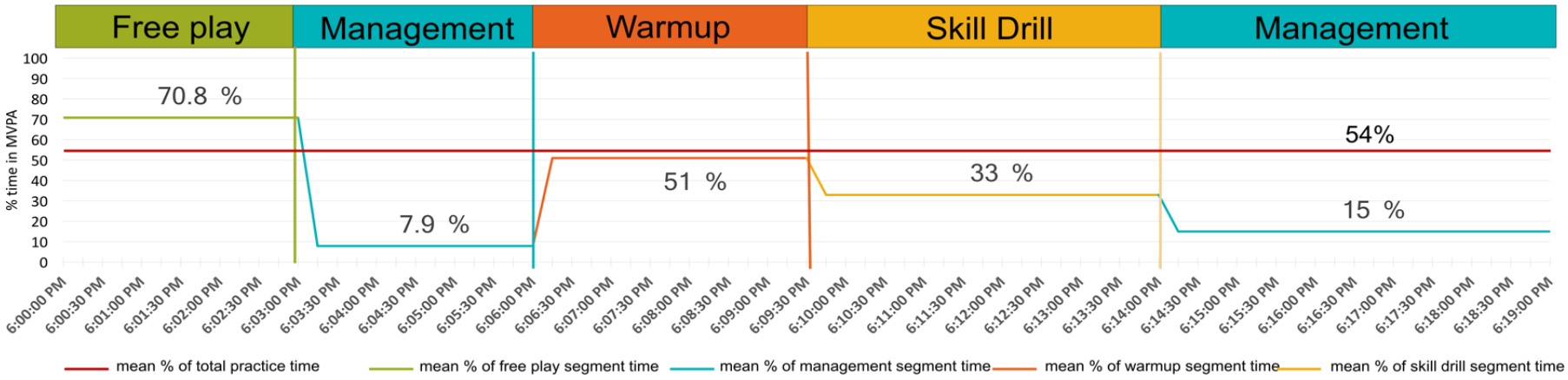


Table 2-1: Team, coach, and child characteristics.

Team, n	12
Sex, % (n)	
Female	50.0, (6)
Male	50.0, (6)
Coach participants, n	12
Sex, % (n)	
Female	8.3 (1)
Male	75.0 (9)
Did not report	16.7 (2)
Race/Ethnicity, % (n)	
Non-Hispanic Caucasian	58.3 (7)
Racial/Ethnic minority	25.0 (3)
Did not report	16.7 (2)
Child participants, n	93
Age, Years (SD)	9.4 (1.1)
Sex, % (n)	
Female	51.6 (48)
Male	48.4 (45)
Free or reduced lunch status, % (n)	
Not eligible	78.5 (73)
Free/Reduced	18.3 (17)
Do Not Know	3.2 (3)
Race/Ethnicity, % (n)	
Non-Hispanic Caucasian	82.8 (77)
Racial/Ethnic minority	13.9 (13)
Prefer not to answer	3.2 (3)

Table 2-2: System 1 results.

Lesson context	% of total practice time (95% CI)	% of intervals in MVPA (95% CI)
Management	18.37 (15.39–21.35)	56.47 (49.52–63.43)
Knowledge	15.15 (10.65–19.65)	33.07 (25.15–40.98)
Fitness	4.04 (2.50–5.59)	85.53 (77.71–93.35)
Skill practice	46.82 (40.30–53.35)	68.39 (62.43–74.35)
Game play	15.48 (7.75–23.21)	81.98 (72.72–91.24)
Coach behavior	**% of intervals with coach behavior (95% CI)**	
In practice	34.40 (28.46–40.35)	
Out of practice	0.05 (0.00–0.13)	
None	65.45 (59.47–71.42)	

Table 2-3: System 2 results.

Segment Type (n = 256)		**Segment Frequency** % (n)	**Segment Frequency** Number/ practice	**Mean Segment Length** Mean min ± SD (range)	**Mean % time in MVPA** Mean % (95% CI)	
Task						
	Warmup	5.47 (14)	0.58	3.57 ± 1.61 (1.5–7.0)	43.67	(40.58–49.72)
	Fitness	7.03 (18)	0.75	3.11 ± 1.61 (1.0–6.0)	39.67	(36.66–45.57)
	Free play	8.59 (22)	0.92	4.32 ± 2.51 (3.0–8.0)	57.49	(54.70–62.96)
	Game play	7.42 (19)	0.79	4.86 ± 2.63 (1.25–10.0)	44.55	(41.73–50.08)
	Management	7.42 (19)	0.79	3.47 ± 3.23 (1.0–11.25)	25.98	(23.16–31.51)
	Scrimmage	5.08 (13)	0.54	8.77 ±7 .02 (1.5–26.0)	50.93	(47.45–57.75)
	Self-care	12.89 (33)	1.38	5.46 ± 5.22 (1.0–22.5)	38.07	(35.56–42.98)
	Sport-skill	33.20 (85)	3.54	4.75 ± 3.41 (1.0–21.0)	37.27	(35.07–41.57)
	Strategy	12.89 (33)	1.38	8.10 ± 5.70 (1.0–24.5)	31.80	(29.31–36.69)
Pattern						
	One-v-One	2.73 (7)	0.29	3.39 ± 0.92 (1.75–4.0)	28.98	(21.09–36.87)
	Small group	2.73 (7)	0.29	5.86 ± 3.93 (1.75–12.0)	40.63	(32.41–48.85)
	Whole group	94.53 (242)	10.08	5.21 ± 4.33 (1.0–26.0)	39.49	(34.83–44.15)
Participant Demand						
	Optimal	52.46 (117)	4.88	5.12 ± 4.07 (1.0–24.5)	44.63	(39.84–49.42)
	Disadvantaged	47.53 (106)	4.42	5.14 ± 4.20 (1.0–26.0)	33.80	(28.98–38.62)

Chapter 3 - Microsystem Drivers of Inequality in Children's Physical Activity During Youth Sport

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Introduction

Physical activity (PA) has numerous health benefits for youth,[1,2] including improved body composition,[2] bone density,[2] and psychosocial outcomes.[1] Physical activity behaviors in youth have been shown to track to adulthood,[3,4] therefore increasing PA in youth is likely to decrease risk for cardiovascular,[1,5] metabolic diseases,[1] and many cancers[6] in adulthood. Despite health benefits, worldwide accelerometer estimates indicate that less than 10% of boys and 2% of girls aged 5-17 years meet recommended PA guidelines[7] of accruing 60 minutes of moderate-to-vigorous physical activity (MVPA) per day.[8]

One strategy to improve children's PA behavior is to use setting-based approaches to change the physical and social environments of the places where children live, learn, and play to be more conducive to healthful behaviors.[9] This approach has been successful at improving health behaviors within numerous youth settings, including preschool,[10] school,[9,11,12] afterschool,[13,14] youth sport,[15] and Girl Scouts.[16] Currently, most estimates of PA accrued during settings is reported as an average for the total setting time (e.g., total sport practice time). In youth sport, only approximately one-third of total practice time is spent in MVPA.[17–20]

Though describing activity during total practice time is useful, averaging PA across the entire setting duration does not allow researchers to examine the pattern of variability in PA that occurs within practice time, or examine contexts that may be driving low activity during youth sport time. Previous research has demonstrated that within setting time, youth PA is highly variable and changes based on social contexts of location[22–24] (i.e., indoors, outdoors), participant arrangement[23,25] (e.g., small group, whole group), task[26–29] (e.g., free-play, fitness), and participant demand[27,30] (e.g., equal number of opportunities to participate as children available for participation [non-elimination game]; unequal number of opportunities to participate as children available for participation [elimination game]). For example, time spent outdoors has been shown to have more activity than time spent indoors,[22,23] and time spent in non-elimination games has been shown to have more activity than time spent in elimination games.[27,30]

In addition to examining the pattern of variability of PA within setting time, there is a need to examine the pattern of variability among individuals within setting time. Setting-based PA is most often assumed to be a normally distributed response of individuals that can be represented by a mean and variability around the mean. However, social ecological theory suggests that the interaction of individuals with the setting is a social microsystem that may

demonstrate homogeneous or heterogeneous PA patterns.[31,32] Currently, little is known about how social contexts affect the pattern or distribution of PA among individuals within setting time, such as whether social structural contexts create inequalities in PA.

One popular measure of distribution and inequality is the Gini coefficient.[33,34] The coefficient ranges from 0, perfect equality (i.e., all children have the same distribution of PA) to 1, complete inequality (i.e., one child has all of the PA).[33–35] Though traditionally used to characterize inequality in income,[33] the measure has also been used to describe inequality in resource distribution (e.g., land and water use),[36,37] plant diversity,[38,39] educational outcomes,[40] and physical activity.[41,42] Althoff and colleagues (2017) recently used the Gini Coefficient to describe inequality in PA of adults across 111 countries, and found that country-level inequality of PA (as measured by the Gini Coefficient) was a better predictor of country obesity prevalence than average volume of steps recorded.[41] In setting-based activity research, the Gini coefficient could be used as a system-level indicator as to whether the structure of the setting microsystem promotes activity by all, or whether the microsystem structure promotes inequality and the accumulation of activity by a subset of a few individuals.

The purpose of this study was to describe the pattern of equality or inequality in PA during time-segmented youth sport practices. We hypothesized that inequality would differ based on the context social structure of the time segment; specifically, time segments that fostered inclusion (i.e., optimal microsystem demand) would have lower inequality than time segments that fostered exclusion (i.e., disadvantaged microsystem demand).

Methods

The protocol for this cross-sectional study was approved by the Kansas State University Institutional Review Board (#7289, 7855).

Settings and Participants

Youth sport teams from the parks and recreation department of a Midwestern city (population >50,000) were recruited for the study in two waves. The first wave was recruited from 5–11 year-old recreation youth sport flag football (i.e., American, non-tackle football) leagues during the fall of 2014. Flag football teams played 1 game/week, practiced 1–2 times/week, and included only boys' teams. The duration, location, and time of each flag football practice was determined by the volunteer coach. Twenty-four teams were invited to participate,

of which 15 volunteered for participation. One team was excluded for a scheduling conflict, resulting in 14 boys' teams for participation. The second wave was recruited from 7–12 year-old recreation youth sport basketball leagues during the winter of 2015 as part of an intervention program. Basketball teams played 1 game/week and practiced 2 times/week and included both boys' and girls' teams. The duration, location, and time of practice was scheduled by the parks and recreation department. Twenty-eight teams were invited to participate (boys = 68%) of which 16 teams volunteered for participation (boys = 50%). Teams that were randomized to intervention (n = 8) or had fewer than 4 players at practice (n = 2) were excluded from the analysis, resulting in 6 basketball teams (boys = 50%).

All players from participating teams were eligible for the study. Players were excluded from analysis if he or she 1) did not return parental consent or 2) did not attend a practice where observation occurred. In total, 126 children from flag football teams and 59 children from basketball teams were eligible to participate. Eighty-eight percent of flag football players (n = 111; boys = 100%) and 80% of basketball players (n = 47; boys = 44.7%) met inclusion criteria and were included in analysis. Coach and child characteristics are listed in Table 1.

Outcome Measures

Physical Activity. Physical activity was assessed using GT1M Actigraph accelerometers (Pensacola, FL, USA). Accelerometers are frequently used in youth PA research,[43] and have been shown to provide valid and reliable estimates of PA.[43,44] Accelerometers were initialized at 15-second epochs to capture the sporadic activity of children in youth sport,[45] and Evenson[46] cut-points were applied to determine minutes of time spent in MVPA (≥ 2296 CPM). Evenson cut-points have been shown to be the most accurate estimation of MVPA for the target age group.[44]

Social Contexts. Each practice was video recorded using the video capability of two iPods (Apple iPod Touch 5th Generation, California, USA) fitted with wide-angle lenses; one iPod was fixed to a tripod and was positioned to view the entire practice area, the other was fit into a belt and worn around waist of the head coach of the team. Videos of practices were uploaded to a video analysis software (NOLDUS, OBSERVER XT 11.5) and coded using an observation system developed by the authors. For more information on the observation system, see Dzewaltowski & Schlechter[54], Schlechter et al.,[27] Rosenkranz et al.,[24] and Coleman et al.,[26] In brief, the observation system uses the method of continuous sampling to divide time into continuous context time segments with naturally occurring start and stop points defined by a

change in context (e.g., task). Each segment was coded for the context characteristics of task (e.g., management, fitness), participant arrangement (e.g., whole group, small group), and participant demand (i.e., optimal [equal number of opportunities to participate as children available for participation]; disadvantaged [unequal number of opportunities to participate as children available for participation]). Definitions and examples of coding scheme variables can be found in Appendix B.

Inequality. The Gini coefficient, a metric frequently used to assess distribution and dispersion of an entity,[33,35,47] was used to describe inequality. The coefficient ranges from 0, a representation of complete equality (i.e., every individual has the same amount of an entity), to 1, a representation of complete inequality (i.e., one individual has all of the entity).[33–35] Two Gini coefficients were calculated for each time segment 1) from total activity counts and 2) from minutes of MVPA.

Procedures

To recruit coaches, a study author attended a coaches' meeting hosted by the parks and recreation department to explain the project to coaches, answer questions, and recruit coaches for participation. After a coach volunteered for participation, a research assistant attended one practice per team to familiarize coaches, parents, and players with accelerometers and video equipment, and to collect parent consent.

After familiarization, research assistants attended 2 practices per team to collect video and accelerometer data. At each practice, research assistants positioned a tripod camera to view the entire practice area and fitted the head coach with a wearable camera. Research assistants placed accelerometers on the right hip of consenting children as children arrived at practice and removed accelerometers at the end of practice. Research assistants recorded camera and accelerometer on and off times, and practice beginning and end times using a universally synchronized clock.

Video Observation

Videos of practices were uploaded to the Noldus Observer XT 11.5 video analysis software where trained research assistants coded practices using an observation system developed by the authors. Each research assistant was trained to use the observation system and

demonstrated at least 80% reliability to the gold standard. For more information on training and reliability, see Dzewaltowski & Schlechter[54] and Schlechter et al., (2018).[26]

Data Reduction

Using a SAS macro developed by the authors, research assistants matched time-stamped accelerometer data with start and stop times of segments derived from video observation. Evenson (2008) cut-points were applied to accelerometer data to determine minutes of MVPA.

Two Gini coefficients were calculated for each segment using the equation proposed by Glasser[35] for ordered data: 1) from the activity counts of each child in the time segment, and 2) from minutes of MVPA of each child in the segment. As a result, each time segment had values for the Gini coefficient derived from activity counts, the Gini coefficient derived from minutes in MVPA, and the contextual variables of task, participant arrangement, and participant demand derived from video observation.

Statistical Analysis

All statistical analysis was conducted in SAS (Version 9.4M5; Cary, NC, USA). Descriptive statistics were calculated for participant and time segment characteristics. Strip-plot, multi-level models with time segment as the unit of analysis[48] were used to examine the influence of context types (i.e., task, pattern, demand) on inequality (i.e., Gini coefficient for total activity, Gini coefficient for minutes in MVPA) for each time segment. Sport (i.e., flag football, basketball) was used as a covariate in the model.[48]

Results

Segment characteristics are presented in Table 2. Overall, research assistants identified 286 unique time segments. Approximately 7 segments occurred per practice (mean = 7.33, SD = 2.82).

Inequality

Across all time segments, inequality in total activity ranged from 0.005 to 0.697 (mean = 0.196, SD = 0.112). Inequality in minutes spent in MVPA across all segments ranged from 0.000 to 0.867 (mean 0.277, SD = 0.179).

Inequality by Context

Adjusted means estimates of inequality and associations between inequality and segment types are listed in Table 2.

Task. Warm-up segments had significantly lower inequality ($p < .05$) in total activity than free-play, gameplay, management, and sport skill segments. Management segments had significantly higher inequality ($p < .05$) in total activity than all other segment types. Warm-up segments had significantly lower inequality ($p < .05$) in minutes of MVPA than free-play, management, self-care, sport skill, and strategy segments. Management segments had significantly higher inequality ($p < .05$) in minutes of MVPA than all other segment types.

Member arrangement. Inequality in total activity and minutes of MVPA was not significantly different ($p < .05$) between whole group, small group, or one-v-one segment types.

Setting Demand. Optimal demand segments had significantly lower ($p < .05$) inequality in total activity than disadvantaged segments. Inequality in minutes of MVPA was not significantly different between optimal and disadvantaged demand segment types.

Discussion

The purpose of this study was to describe the pattern of equality or inequality in PA during youth sport practices. The results of the study supported our hypotheses, that inequality would vary based on the type of context of the time segment, and that time segments that fostered inclusion would have lower inequality than time segments that fostered exclusion.

One determinant of children's behavior is the social contexts of the places that they enter throughout the day to live, learn, and play. The social contexts of the setting can provide support, as well as constraints for children to accrue PA during setting time.[49] For example, during an elimination game, the context is structured such that at the beginning of the game there is an opportunity for all children to participate. But, as the game progresses and children are eliminated, the number of opportunities to participate decreases, and children are forced out of participation. Thus, even those children who are highly motivated to participate in the game are constrained in their individual agency to participate[49] based on the rules of the game. Because of this, the context promotes unequal distribution in participation, and activity, such that a limited number of children have the opportunity to participate.

The present study indicated that characteristics of the routine social contexts, specifically the demand and task of the time segment, created variability in the inequality of distribution of PA among children in youth sport practices. Time segments structured to foster inclusion (i.e., optimal demand) had significantly lower inequality in total activity than time segments structured to foster exclusion (i.e., disadvantaged demand). Research in physical activity

promotion can benefit by drawing from the basic social ecological systems theory, which many contemporary evidence-based practices were originally based on. As described originally by Barker and Gump,[31] behavior settings that require more individuals for participation to complete an activity than the number of children available to participate are likely to drive more participation than settings with more children than necessary. Research on PA in youth settings has built on this social ecological systems process, and numerous best practices[50–53] have been proposed for leaders to structure setting time to encourage participation, rather than foster exclusion, to increase PA. These practices include eliminating the use of lines, using non-elimination games, using small-sided games that promote efficient use of space, and providing ample equipment.[50–53] Though previous research has demonstrated that time structured to foster inclusion (i.e., optimal demand) has higher PA than time structured to foster exclusion (i.e., disadvantaged demand),[27,30] this study demonstrates that in addition to having higher amounts of mean PA, optimal demand also promotes more equal distribution of PA across all children in the setting than disadvantaged demand. To create improvements in child population PA, researchers and practitioners should focus not only on mean PA, but also on the distribution of PA within setting time.

In addition to demand, task types of time segments also influenced variability in inequality. Management segments had significantly higher inequality in total activity and minutes of MVPA than all other task types, while warm-up segments had the lowest inequality, including significantly lower inequality compared to free-play segments. Previous research has shown children's activity to be higher in free-play segments, where children have autonomy in activity choice, compared to adult-structured activity time,[26,27] where the leader of the time segment structures activity choice. Our analysis indicated that the distribution of PA during unstructured free-play segments was less equal than in warmup, a more structured segment type. Thus, even though mean activity has been shown to be highest during free-play, the present study indicated that activity is likely unequally distributed amongst children in the setting. To improve PA for all children during setting time, leaders of settings should structure the setting routine to include a balance of structured and unstructured opportunities for activity.

Of interest is the difference in inequality between segment types for total activity and minutes of MVPA. For example, warm-up segments had significantly lower inequality in total activity than gameplay segments, but inequality in minutes of MVPA was not significantly

different between the task types. Total activity was assessed using raw accelerometer activity counts, rather than minutes, and included all activity, not just MVPA. As such the overall variability in raw activity counts was likely higher than variability in minutes of MVPA. Though current PA guidelines do not include a recommendation for children to accrue light activity, establishing the relationship of total activity to health has been highlighted as an important research aim.[1] Thus, examining inequality in total activity is still warranted.

The current study is not without limitations. We observed youth sport practices in only one Midwestern town, included only 2 recreation sports, observed a limited number of female teams, and only observed two practice days, thus generalizability of results may be limited. Though the Gini coefficient is commonly used to describe inequality, the metric is limited to describing only the existence of an inequality, but does not indicate where the inequality occurs, such that two time segments with different distributions of PA could have the same coefficient. In contrast, the study has several strengths. We used an objective measure to assess PA, and a novel observation method to characterize the natural routine social structure of youth sport practices. To our knowledge, this is the first study to examine inequality in physical activity during youth setting time.

In conclusion, social contexts of demand and task were associated with variability in inequality during youth sport practice time. To create improvements in child population PA, researchers and practitioners should focus not only on the mean PA of setting time, but also on the distribution of PA among children within setting time.

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Figure 3-1: Children's physical activity across time of one disadvantaged and one optimal demand segment.

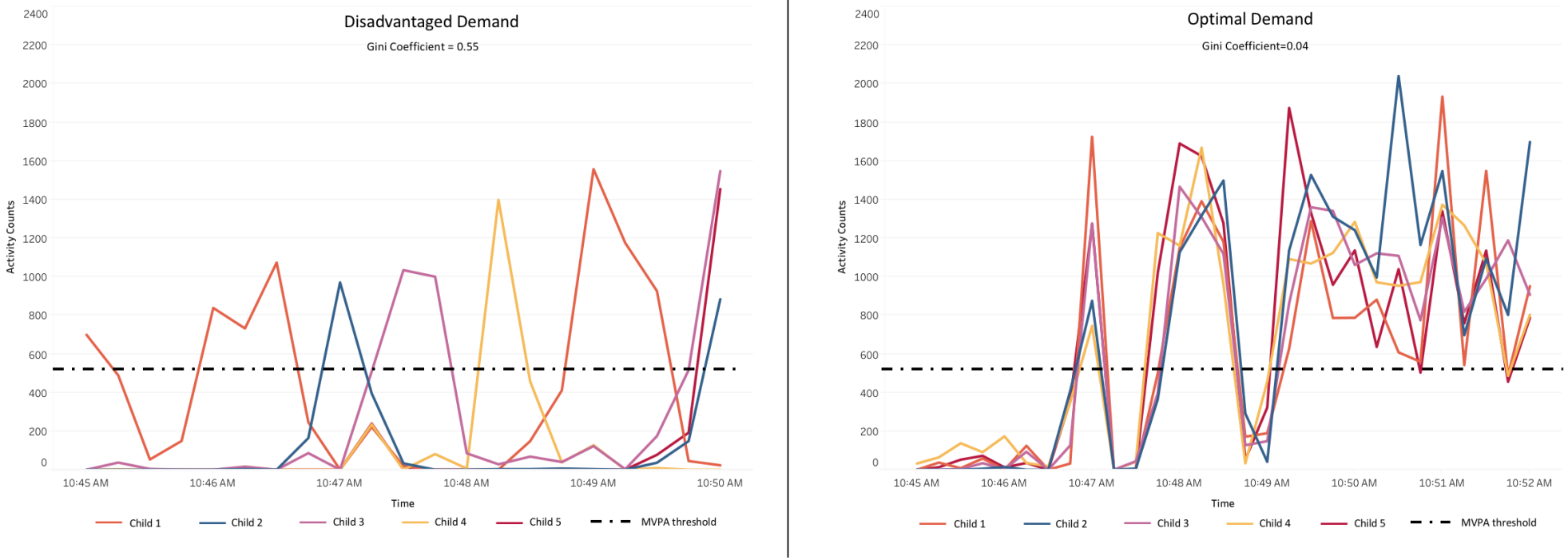

Table 3-1: Coach and child characteristics.

Coach participants, n	20
Sex, % (n)	
Female	15.0 (3)
Male	85.0 (17)
Sport, % (n)	
Basketball	30.0 (6)
Flag Football	70.0 (14)
Race/Ethnicity, % (n)	
Non-Hispanic Caucasian	70.0 (14)
Racial/Ethnic minority	25.0 (5)
Did not report	5.0 (1)
Child participants, n	158
Sport, % (n)	
Basketball	29.7 (47)
Flag Football	70.3 (111)
Age, Years (SD)	8.9 (1.4)
Sex, % (n)	
Male	83.5 (132)
Female	16.5 (26)
Free or reduced lunch status, % (n)	
Not eligible	70.3 (111)
Free/Reduced	24.1 (38)
Do Not Know	3.6 (5)
Did not report	2.5 (4)
Race/Ethnicity, % (n)	
Non-Hispanic Caucasian	75.9 (120)
Racial/Ethnic minority	23.4 (37)
Prefer not to answer	<.1% (1)

Table 3-2: Segment characteristics and adjusted means estimates of inequality.

Segments (n = 286)	**%, (n)**	**Gini Coefficient ± SE (Total activity)**	**Differences* ($p < .05$)**	**Gini Coefficient ± SE (MVPA)**	**Differences* ($p < .05$)**
Task					
Warmup[a]	6.99, (20)	0.13 ± 0.03	c,d,e,g,h,i	0.15 ± 0.04	c,e,g,h,i
Fitness[b]	2.45, (7)	0.17 ± 0.04	E	0.21 ± 0.07	e
Freeplay[c]	3.50, (10)	0.22 ± 0.03	a, e	0.31 ± 0.06	e
Gameplay[d]	5.94, (17)	0.19 ± 0.03	a, e	0.24 ± 0.04	e
Management[e]	13.29, (38)	0.31 ± 0.02	a,b,c,d,f,g,h,i	0.44 ± 0.03	a,b,c,d,f,g,h,i
Scrimmage[f]	6.64, (19)	0.15 ± 0.03	E	0.21 ± 0.04	e
Selfcare[g]	11.54, (33)	0.22 ± 0.02	a, e	0.30 ± 0.03	a, e
Sport Skill[h]	30.42, (87)	0.19 ± 0.01	a, e	0.26 ± 0.02	a, e
Strategy[i]	19.23, (55)	0.20 ± 0.02	a, e	0.28 ± 0.02	a, e
Member Arrangement					
Whole Group	92.31, (264)	0.20 ± 0.01	None	0.28 ± 0.01	None
Small Group	4.90, (14)	0.16 ± 0.03	None	0.23 ± 0.05	None
One-v-One	2.80, (8)	0.15 ± 0.03	None	0.34 ± 0.06	None
Demand					
Optimal[a]	68.38, (173)	0.18 ± 0.01	B	0.26 ± 0.02	None
Disadvantaged[b]	31.62, (80)	0.21 ± 0.01	A	0.29 ± 0.02	None

Chapter 4 - Characterizing the School System Structure to Support Health and Wellness

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Introduction

Approximately 17% of youth and adolescents (2-19 years) in the United States are considered obese[1] and less than half of children are meeting recommended dietary[2] or physical activity (PA) guidelines.[3] One strategy used to improve children's PA and nutrition behaviors is to change school environments to be more conducive to health behaviors, but improvements in health behaviors are highly variable across interventions,[4] and are rarely evaluated or maintained post intervention.[4–6] Improvements in child PA and nutrition behaviors within the school setting are largely dependent on whether or not practice changes to improve the school environment were actually implemented within the school system.[7–9]

To attempt to enhance implementation of best practices for healthy eating and PA in the school environment, the Healthy Hunger Free Kids Act (HFFKA)[10] requires that each school system participating in the National School Lunch Program establish a local wellness policy leadership committee and create a local wellness policy that each school within the system must implement.[10] Information and resources regarding how to implement the policy would be expected to be exchanged from the committee that created the policy to the school personnel expected to implement the policy. However, the exchange of information and resources, and the implementation of practices, within a school is influenced by the existing social structure of the school system where the practice is introduced.[11–14]

Despite evidence that working with the existing social structure is likely to increase implementation,[11,13–15] there is currently a gap in the literature as to characteristics of the social structure of school district systems that may influence implementation of practices focused on health and wellness into schools. The purpose of this study was to describe a method and to investigate the social structure between school district wellness committees and their elementary schools.

Methods

This cross-sectional study was conducted throughout the 2016-2017 academic year. The data presented in this study were collected as part of the Healthy Kansas Schools project (HKS), a program funded in part by the Centers for Disease Control and Prevention (1305 State Public Actions to Prevent and Control Diabetes, Heart Disease, Obesity and Associated Risk Factors and Promote School Health) and conducted in partnership between the Kansas Department of

Health and Environment (KDHE) and the Kansas State Department of Education (KSDE). The goal of HKS is to assist school districts in building their capacity to adopt and implement policies and practices to improve student PA, healthy food choices, tobacco use, and management of chronic conditions.[16] The Kansas State University Institutional Review Board and the Kansas Department of Health and Environment Institutional Review Board approved the study protocol.

Participants

In 2014, KDHE and KSDE selected 12 school districts (total Kansas school districts, n = 373) that met eligibility criteria to participate in HKS project. Eligibility criteria for the project included: 1) have a least one physical education (PE) teacher trained on the Comprehensive School Physical Activity Model, 2) serve free/reduced lunch to at least 55% of students, 3) employ a full-time nurse, 4) be located in a Kansas county wherein the health department is a Chronic Disease Risk Reduction Grantee, and 5) at the time of application submission not have a current school health assessment or wellness action plan on file.[16] Each HKS school district was required to designate one grant coordinator to lead the project and participate in monthly regional calls with the project staff. All HKS grantee districts (n = 12) were eligible to participate in the study. School districts were located in multiple geographic regions across the state and ranged in size from one elementary school per district to 30 elementary schools per district (mean = 9.25, SD = 7.94).

Measures

District and School Wellness Committee Composition. Existing social structure was defined by characteristics of wellness committees at the district level and school level. Each school district was asked to complete a short questionnaire regarding the existence and composition of the district wellness committee, team, or group (hereafter referred to as committee). A representative from each elementary school in the district was asked to complete the same survey for the existence and composition of the elementary school wellness committee. Specifically, the survey asked 1) Does a wellness committee exist? 2) What is the name and position (e.g., principal, community member, etc.) of each member of the committee?

District and School Wellness Committee Routines. On the survey described above, each school district and each elementary school within each district was asked to report 1) What is the

frequency of committee meetings? and 2) What is the duration of the committee meetings? This provided a measure of the routine social structure of the committees.

School System Organization Structure. To capture the social structure of relations that exist between the school district wellness committees and their elementary schools vertically along the organization hierarchy, within each district we assessed the number of elementary schools represented on the district committee divided by total number of elementary schools in the district.

Procedures

Data Collection. During the fall of 2016, a study author (CS) conducted a training at the HKS annual meeting where each grant coordinator completed a questionnaire regarding the district wellness committee composition and routine (described above), and identified a champion from each elementary school in their district. Grant coordinators were asked to contact champions and have each champion complete a similar questionnaire regarding school committee composition and routine for his or her respective elementary school. Completed surveys were mailed or emailed back to the research team during the remainder of the 2016-2017 school year.

Data Reduction and Analysis. Descriptive statistics of wellness committee existence, composition, and routine were calculated in SAS (Version 9.4; Cary, NC, USA).

Results

Wellness Committee Composition. Descriptive information of district and school committee composition can be found in Table 1.

District. All twelve districts reported having a district committee. Average committee size was mean = 13.92 people, SD = 6.99. All twelve committees included physical education (PE)/health teachers, and most committees included classroom teachers, nurses, and a superintendent on the committee (Table 1). All 12 committees included representatives from at least 3 different positions.

School. Forty of the 111 elementary schools (36.0%) in the 12 target districts reported having a school committee. Nine school districts (75.0%) had at least one elementary school with a school committee. The percentage of elementary schools with a school committee per district ranged from 0–100% (mean = 50.77%, SD = 44.23%). Average committee size was mean = 4.71 people, SD = 4.16. Most committees included classroom teachers, PE/Health teachers, and

principals or assistant principals (Table 1). Thirty-nine committees (97.5%) included representatives from at least 3 different positions on the committee

Wellness Committee Routine.

District. Committees met more than 6 times per year (41.67%, n = 5), 4 times per year (33.33%, n = 4), and 2 times per year (25%, n = 3), respectively. Committees had meetings with a duration of 60 minutes (58.33%, n = 7), 75 minutes (16.67%, n = 2), 90 minutes (8.33%, n = 1), or 30 minutes (8.33%, n = 1), respectively. One committee did not report meeting duration.

School. Thirty-one committees (77.50%) reported meeting regularly. Committees that met regularly met more than 6 times per year (35.48%, n = 11), 4 times per year (32.25%, n = 10), 2 times per year (29.03%, n = 9), and less than 2 times per year (3.22%, n = 1), respectively. Committees had meetings with a duration of 30 minutes (41.94%, n = 13), <30 minutes (25.81%, n = 8), 60 minutes (16.13%, n = 5), 45 minutes (12.90%, n = 4), 90 minutes (3.22%. n = 1), respectively.

School System Organization Structure. The proportion of elementary schools represented on the district committee (mean = 0.48, SD = 0.39) ranged from 0.0 (no elementary schools represented on district committee) to 1.0 (all elementary schools represented on district committee). Visual representation of the school system organization structure of two school districts in this study and can be found in Figures 1 and 2.

Discussion

The purpose of this study was to describe a method to investigate the social structure between school district wellness committees and their schools and to investigate the existence, composition, and routine of district and school wellness committees. Results of the study showed wide variability across school districts, with some districts having a social structure with representation of schools on the district wellness committee, and other districts with no representation.

Each of the 12 school districts in the current study is a unique social system defined by the boundary of the district (depicted in Figures 1 and 2). Within these systems are formal relationships between organizations (i.e., district office, school) and individuals within organizations (i.e., within the district office, within the school). Formal relationships of school systems are typically structured to create a hierarchy where the district has top-down influence over individual schools within the district. Large scale legislative reforms targeted at school

systems, such as the HHFKA,[10] typically target the district to create policies and mandates regarding practice changes that are to be implemented within individual schools. However, the success of implementation at the school level may be largely dependent on the existing social structure of that school system. Researchers studying the implementation of No Child Left Behind in school systems have demonstrated that school system structure is associated with school performance and the flow of information and resources.[18,19] Daly and Finnigan[19] conducted a social network analysis with school administration and found that schools with the fewest connections to the district office had fewer resources and were lower performing than their well-connected counterparts.

We defined the relationship structure between the district and the school as the district wellness committee including a representative from the elementary school on the committee. Ideally, all schools would be represented on the district committee, thereby creating a communication channel from the district to the school through which ideas, resources, and information can flow (depicted in 'A' in Figures 1 and 2). We found that the proportion of elementary schools represented on the district committee was highly variable across districts, ranging from no schools represented on the committee to all schools represented on the committee. Because of this social structural difference, these school systems likely require unique strategies to enhance implementation of policies and practices.[11,13]

In addition to having communication channels from the district to the school, ideally each school would have a committee to facilitate communication across different groups (e.g., classroom, food service) *within* a school (depicted in 'C' in Figures 1 and 2). Overall, less than half of elementary schools (36%) in the current study reported the existence of an established school committee, and the percentage of elementary schools within each district with an established committee ranged from 0% to 100%. Within the same school district, the structure of relations within each elementary school was highly variable. As each of these elementary schools has a unique social structure, the way information and resources are spread through the schools is unlikely to be uniform. This variability should be investigated and used by researchers and practitioners to enhance implementation success.

Investigating and using the existing social structure is important when designing and implementing policies and practices, because rather than disregarding the opportunities and constraints that influence how individuals and collectives act in an existing social structure,[14] the

existing social structures can be used for individuals and collectives to foster implementation success.[7,11] As described by the Diffusion of Innovation Theory[11] and supported by research conducted in farming,[11] school systems,[19] healthcare,[20] organizations,[15] and communities,[11] the number and types of relationships in a social system influence the implementation of ideas and practices into that system. Social systems with few relationships and many disconnected groups have been shown to be conducive to generate new ideas and innovations;[11] in contrast, social systems that have many relationships, and relationships that span boundaries between subsystems of an organization (e.g., between the district and the school; within different settings of the school such as the lunchroom and the classroom), have been shown to positively influence implementation of evidence-based practices within organizations.[15,21,22]

One strategy shown to increase implementation of evidence-based practices in an organization is to build communication channels within an organization by establishing multidisciplinary project committees that span the boundaries of subsystems within an organization (e.g., between the district and the school; between different areas of the school such as food service, classroom, physical education).[22,23] Heterogeneous committees comprising a variety of positions have been shown to increase implementation and adoption of evidence-based practices in an organization[15] as they encompass a variety of skill sets and knowledge,[23] and serve as channels for external communication outside of the committee.[11,23,24] In school systems, Kubic and colleagues[25] demonstrated that schools with an established district and school wellness committees had higher quality food environments in middle and high schools compared to those without committees.[25]

To increase implementation of wellness policies within school systems, researchers[26,27] and organizations such as the Center for Disease Control and Prevention,[28] United States Department of Agriculture,[28] and the Alliance for a Healthier Generation[29] recommend creating an organizational system for health and wellness within the school system. Best practices recommended by these organizations include creating wellness committees at the district and the school level, including a variety of positions on these committees (e.g., food service, school nurse, PE teacher, community member), and ensuring the committees meet at least two times per semester.[28,29] Though multiple case-studies have supported these best practices[28] only one empirical study to date has found a relationship between the best practices described above and implementation outcomes.[30] In Maryland schools, school systems that met the best practices

described above were more likely to have high rather than low implementation, compared to schools not meeting best practices.[30] Further research is needed to examine the social structural characteristics that are most conducive to implementation of policies and practices within the school system.

The current study is not without limitations. As our sample included only 12 districts from a single Midwestern state, the generalizability of our findings may be limited. This cross-sectional study assessed structural characteristics at only one time point and therefore did not capture dynamic changes in structure that occur across time. We assessed only formal relationships (i.e., official relationships among members of the social system) between positions and did not capture informal relationships (i.e., unofficial relationships),[17] which provide another channel for transmission of information and have been shown to influence adoption and implementation of policies and practices.[11,17,31] Furthermore, as the purpose of the study was to describe social structural characteristics, we did not assess implementation outcomes and are therefore unable to describe the association of structural characteristics with implementation of policies and practices. In contrast, the study has a number of strengths. This study provided a novel method to describe and visualize the social structure of school systems. Data were collected by existing members of the social system, and represent a variety of school district sizes. To our knowledge, this is the first study to characterize the organizational structure of school districts related to health and wellness.

In conclusion, the social structure of school systems is highly variable across and within school districts. As social structure characteristics influence the implementation of policies and practices within social systems, these characteristics should be investigated by practitioners and researchers, and should be used to enhance implementation, rather than be disregarded, or in some instances, controlled for. The current study provides a method to describe the social structure of school systems, but future research is needed to examine the processes in which social structural characteristics can be used to improve implementation of policies and practices within school systems.

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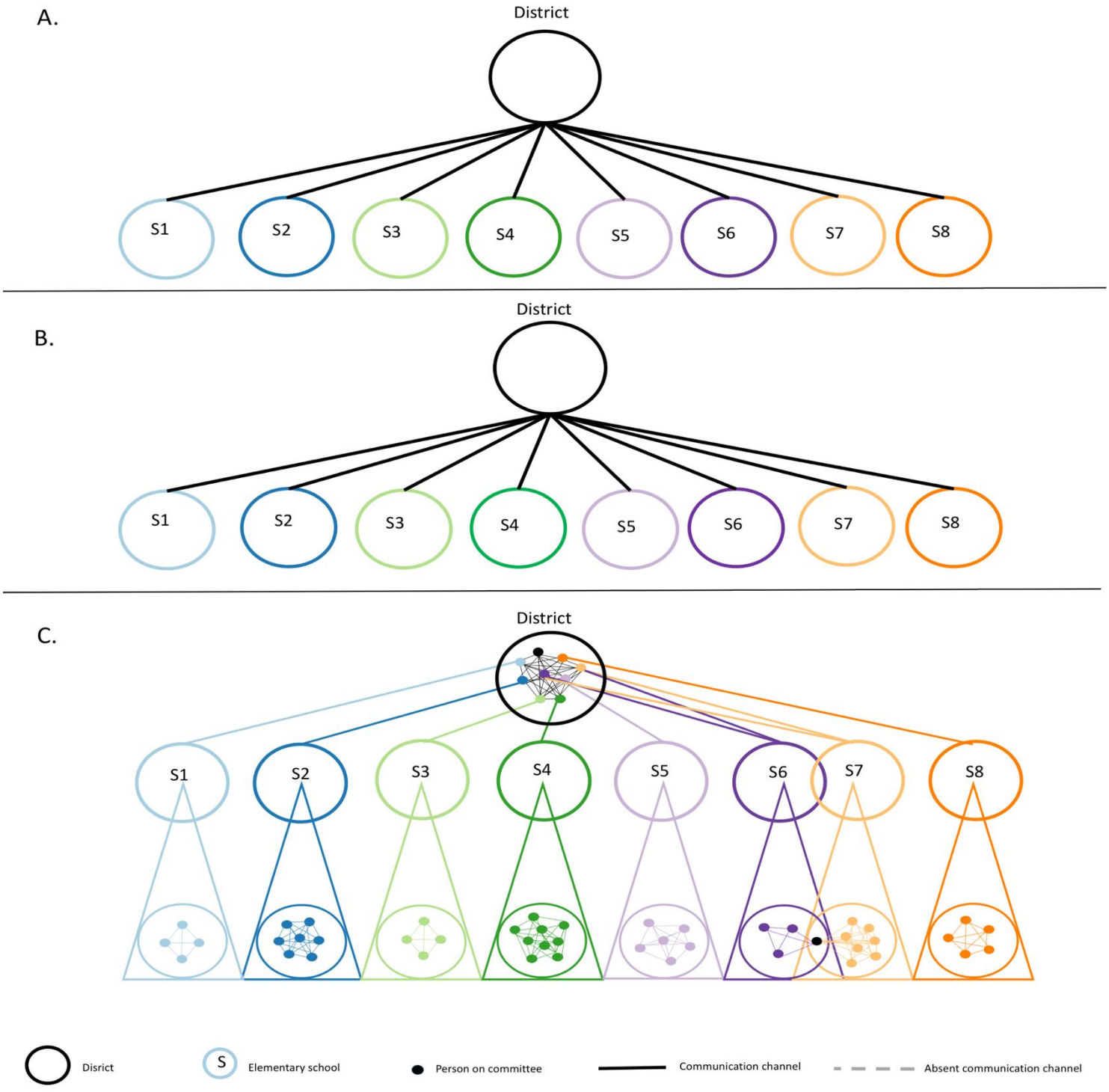
Table 4-1: District and school committee composition.

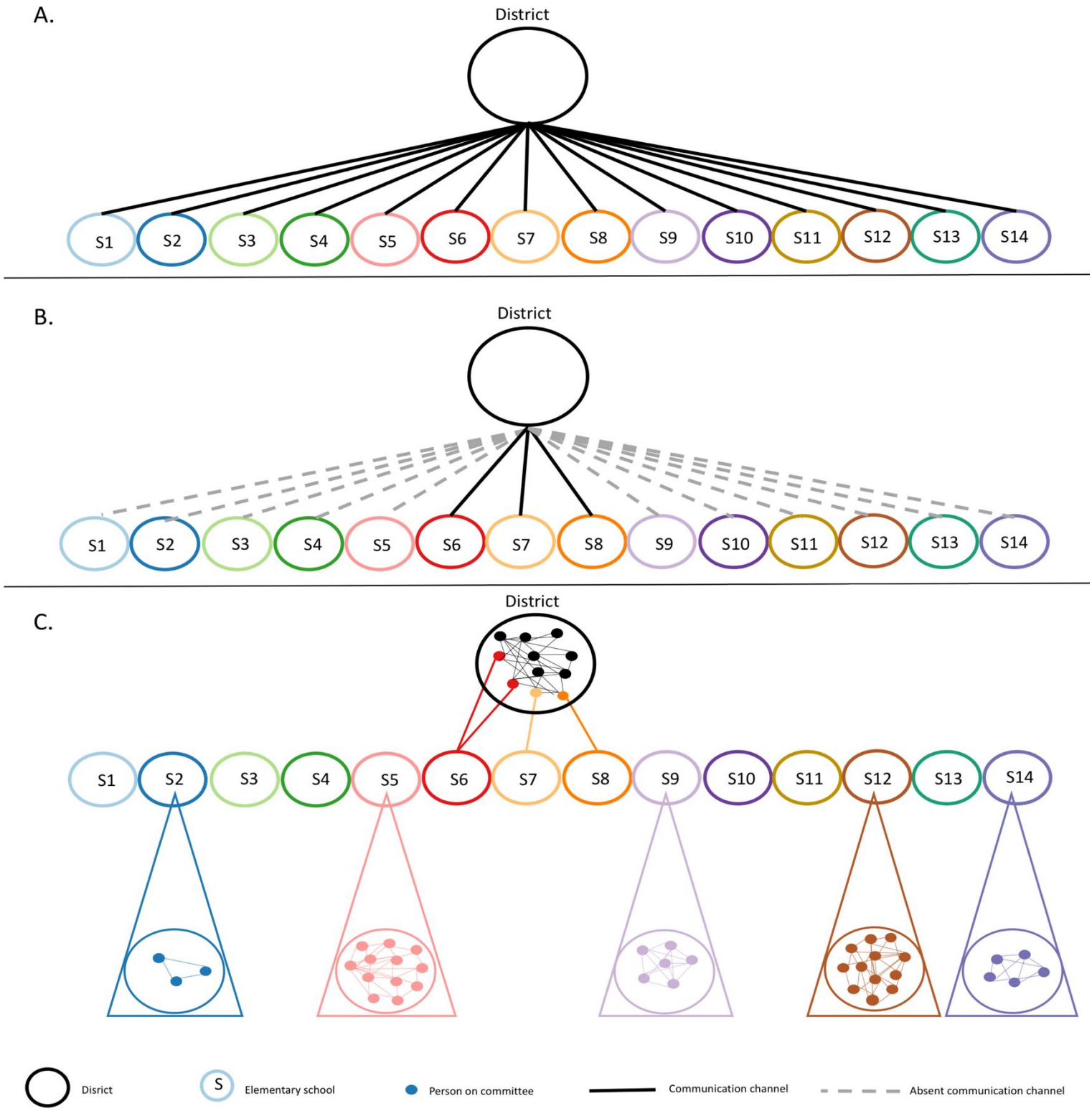
	District		School	
	Committees that included the position, % (n)	**Committee members who held the position, % (n)**	**Committees that included the position, % (n)**	**Committee members who held the position, % (n)**
	Total teams, n = 12	Total team members, n = 152	Total teams, n = 40	Total team members, n = 280
Position				
PE/Health teachers	100%, (12)	21.1%, (32)	87.5%, (35)	15.7%, (44)
Classroom teachers	75%, (9)	15.8%, (24)	95.0%, (38)	33.6%, (94)
Nurse	75%, (9)	10.5%, (16)	62.5%, (25)	10.0%, (28)
Nutrition and food service	66.7%, (8)	5.2%, (8)	25.0%, (10)	3.6%, (10)
Superintendent	66.7%, (8)	5.2%, (8)	0%, (0)	0%, (0)
School Board	58.3%, (7)	3.3%, (7)	2.5%, (1)	.4%, (1)
School administration	50%, (6)	6.6%, (10)	35.0%, (14)	5.4%, (15)
Community members	50%, (6)	5.9%, (9)	22.5%, (9)	6.4%, (18)
School counseling and social work	41.7%, (5)	3.9%, (6)	20.0%, (8)	2.9%, (8)
Principal/assistant principal	41.7%, (5)	4.6%, (8)	52.5%, (21)	7.9%, (22)
Local hospital	41.7%, (5)	3.3%, (5)	0%, (0)	0%, (0)
YMCA/Rec	33.3%, (4)	2.6%, (4)	0%, (0)	0%, (0)
Extension agent	33.3%, (4)	2.6%, (4)	0%, (0)	0%, (0)
Local health department	25%, (3)	2.0%, (3)	5.0%, (2)	.7%, (2)
Staff wellness coordinator	16.7%, (2)	1.3%, (2)	0%, (0)	0%, (0)
Human Resources	8.3%, (1)	1.3%, (2)	0%, (0)	0%, (0)
School technology staff	0%, (0)	0%, (0)	15.0%, (6)	2.1%, (6)
Librarian	0%, (0)	0%, (0)	12.5%, (5)	1.8%, (5)
Other school staff	16.7%, (2)	2.6%, (4)	25.0%, (10)	4.6%, (13)
Student	0%, (0)	0%, (0)	12.5%, (5)	5.0%, (14)

Figure 4-1: Social structure of relationships between the district and elementary schools within each district.



Panel A represents the ideal structure between the district and schools, where each elementary school has a communication channel to the district. *Panel B* represents the actual structure between the district and schools. In this district, every elementary school was represented on the district committee *Panel C* represents the structure between people on the district committee, and between people on school committees. In this district, every elementary school in the district reported an existing school committee.

Figure 4-2: Social structure of relationships between the district and elementary schools within each district.



Panel A represents the ideal structure between the district and schools, where each elementary school has a communication channel to the district. *Panel B* represents the actual structure between the district and schools. Only 3 of the 14 elementary schools in the district reported an existing wellness committee. *Panel C* represents the structure between people on the district committee, and between people on school committees. Five elementary schools reported an existing school committee, none of which were represented on the district committee.

Chapter 5 - Dissertation Conclusion

The purpose of this dissertation was to examine social contexts of youth settings and describe contextual influences on youth PA. The chapters described methodological considerations for examining social contexts of youth settings, and tested the influence of contextual influences on the amount and distribution of PA within youth settings.

Many researchers use a social ecological approach to understand the multi-faceted influences on youth PA, and use direct observation as a rigorous way to describe contextual influences on child PA. As described in Chapter 1, DO systems have been designed to characterize a variety of contextual influences, and use a variety of observation methods. We identified 20 existing DO systems from the literature, and found that most systems assessed contextual influences of purpose/lesson context and leader behavior. We found that few DO systems are currently using methods that generate the type of data necessary for real-time activity and context assessment, to answer research questions that include a temporal component, or to answer research questions about the distribution of PA within settings.

In Chapter 2, we proposed that rather than the tool or established observation system defining the data collected, the research question should provide the rationale for the decisions that define the type of data obtained and the DO method used.[3,4] We highlighted three key methodological decisions each researcher should make based on his or her research question: 1) the spatial and temporal boundary of the stable context for observation, 2) the level of observation, and 3) the sampling methods. Using youth sport as an example, we compared two observation systems comprised distinct methods, and found each system resulted in distinct types of data. System 1 defined the boundary of the social context as total youth sport practice time, used a group level of observation, and used instantaneous sampling of individuals. These methods resulted in the system characterizing PA and context across total practice time. Because of the methods used, the system was not able to characterize PA and context within youth sport practice time, and was not appropriate for answering research questions involving a temporal component. System 2 defined the boundary of the social context as continuous context (e.g. task; goal of the time period) within youth sport practice time, used group level of observation, and used continuous sampling of the group. This system characterized variability in context and PA within youth sport practice time. In summary, distinct methods result in distinct types of data,

and researchers should choose the methods most appropriate for answering his or her research question.

In Chapter 3, we described the pattern of equality or inequality in the distribution of PA during time segmented youth sport practices using DO and accelerometry. Overall, inequality ranged from 0.005 to 0.697 (mean = 0.196, SD = 0.112) for total activity (TA), and 0.000 to 0.867 (mean 0.277, SD = 0.179) for minutes spent in moderate-to-vigorous physical activity (MVPA). Our hypothesis, that inequality would differ based on the context social structure of the time segment, was supported. Time segments structured in optimal demand (i.e., fostered inclusion by all) had significantly lower inequality in TA than segments structured in disadvantaged demand (i.e., fostered exclusion). Inequality also differed by the task type of the time segment, with management segments having significantly higher inequality in TA and minutes in MVPA than all other segment types. Previous research has demonstrated that social contexts, including leader practices, influence the amount of PA accrued during youth setting time. This study builds on that research, and demonstrated that contexts not only affect the amount of PA, but also the distribution of PA within youth settings. To create improvements in child population PA, researchers and practitioners should focus not only on the mean PA of setting time, but also on the distribution of PA among children within setting time.

Previous research has supported multiple evidence-based practices for improving youth PA within settings, however, implementation of these practices within settings is difficult to obtain and rarely sustained. In Chapter 4 we presented a method to investigate the existing social structure between school district wellness committees and their elementary schools that may influence implementation of practices for improving youth health behaviors. Results of the study indicated large variability in structure across and within school districts. All districts reported the existence of a school wellness committee, while only 36% of elementary schools reported a school committee. The proportion of elementary schools represented on the district committee (mean = 0.48, SD = 0.39) ranged from 0.0 (no elementary schools represented on district committee) to 1.0 (all elementary schools represented on district committee). This variability should be investigated and used by researchers and practitioners to enhance implementation success rather than be disregarded. In order to enhance translation of research into practice, future research is needed to determine the social structural characteristics that are

most conducive to implementation in school systems, and how to use the existing social structure to enhance implementation.

In conclusion, this dissertation provides multiple contributions to the literature. We presented a novel observation system that is appropriate for describing real time changes in PA and context that occur across time, as well as to describe the influence of contexts of the distribution of PA within setting time. Using this observation system, we supported existing research, that social contexts influence PA, and provided preliminary evidence that social contexts also influence the distribution of PA within settings. To our knowledge, this is the first study to describe inequalities in the distribution of PA within youth settings. Though this dissertation provided evidence that social contexts influence the distribution of PA within setting time, further research is needed to describe characteristics of the children that accrue disproportionally high and low amounts of activity within setting time. Finally, we presented a method to characterize the existing social structure of school district systems by describing relationships among school district wellness committees and elementary schools within the district. In order to enhance translation of research into practice, future research is needed to determine the social structural characteristics that are most conducive to implementation in school systems, and how to use the existing social structure to enhance implementation.

Appendix A - Direct Observation System Summary Table

System	Setting	Target Audience Age	Boundary	Level	Temporal sampling	Focal sampling	Contexts	PA
BEACHES[31]	Home, school	4-8 years	Period of time at home (90 minutes), during school lunch (20 minutes), during recess (30 minutes)	Individual	Partial interval 25 second observe, 35 second record • antecedent, interactor, and prompted event, child response, consequences, events receiving consequences Momentary time sampling 25 second observe, 35 second record • PA, environment, and location	Focal child • Follow one focal child for the entire duration of the observation	Environment • Alone • Mother • Father • Siblings • Peers • Teachers • Other adults • Food available • Views TV Physical Location • Inside home • Outside home • Outside general • Playground/play space • Inside school • Cafeteria • Outside school • School play space Eating behavior • Ingests no food • Ingests food Interactor • Alone • Mother • Father • Siblings • Peers • Teacher • other adults Antecedent • None during interval • Prompts to increase • Prompts to decrease • Provides imitative model • Child request Prompted event • Not applicable	Activity level • Lying • Sitting • Standing • Walking • Very Active

							• High intensity activity • Low intensity activity • Food <u>Child response</u> • None during interval • Complies • Refuses <u>Consequences</u> • None during interval • Reinforce/positive feedback • Punish/negative feedback <u>Events receiving consequences</u> • Not applicable • High intensity activity • Low intensity activity • Food • Child request	
SOFIT[35]	PE, After-School, youth sport	Elementary school	Total setting time	Group	<u>Partial interval</u> 10 second observe, 10 second record • Teacher behavior <u>Momentary time sampling</u> 10 second observe, 10 second record • PA, lesson context	<u>Focal child</u> • Choose 4 children and one alternate • Follow each child for 4 minutes then rotate to the next child	<u>Lesson context</u> • General content • Knowledge • Fitness • Skill practice • Game play • Other <u>Teacher Behavior</u> • Promotes in class • Promotes out of class • No promotion	<u>Activity level</u> • Lying • Sitting • Standing • Walking • Vigorous
SOFIT-P[23]	Preschool	3-6 year old	Active times in preschools (i.e., time not including nap or meal times)	Group	<u>Momentary time sampling</u> 20 second observe, 10 second record Momentary time sampling • PA level, type, and context	<u>Focal child</u> • Choose 4 children and one alternate • Follow each child for 4 minutes then rotate to the next child	<u>Indoor Context</u> • Art • Books/preacademic • Group Time • Large Blocks • Manipulative • Music • Sociodramatic • Teacher Arranged • Time Out • Transition <u>Outdoor Context</u> • Ball • Fixed	<u>Activity level</u> • Lying • Sitting • Standing • Walking • Very active

							• Game • Open Space • Sandbox • Socioprops • Teacher Arranged • Time Out • Wheel Activity type • Lie down/sit/ stand/squat • Climb/crawl • Walk/ride • Push/pull/ throw • Rock/swing • Dance/jump/ skip • Run/throw/ rough and tumble	
SOFIT+[24]	PE	Elementary (1^{st}, 2^{nd} 3^{rd})	Total PE time	Group	Momentary-time sampling 10 second observe, 10 second record in two phases (40 total seconds) • First: lesson context and activity context; • Second: teacher behavior, activity management Partial interval 10 second observe, 10 second record in two phases (40 total seconds) • Lesson context, activity context, teacher, behavior, activity management	Phase 1: Focal child Phase 2: Teacher Behavior: interactions can be directed at any student in the class not just the target student	Lesson Context • General content • Knowledge content • Motor content • Fitness • Skill practice • Game play • Free play Activity Context • Individual activity • Partner activity • Small-sided activity • Whole-class activity • Waiting activity • Elimination activity • Students off task Teacher behaviors • Demonstrate/instructs • Promotes PA • PA as punishment • Withholding PA • PA engaged • Teacher off/other task Activity Management • Freezing • Retrieving equipment many access points • Retrieving equipment many access points • Grouping	Accelerometers

							• Addressing interruptions public • Addressing interruptions private	
C-SOFIT[16]	PE	Middle school	Total PE time	Group	Continuous sampling • Total duration	Focal child • Choose 4 children • Rotate through children every 4 minutes	Lesson context • Management • General knowledge • Fitness knowledge • Fitness • Skill practice • Game Play • Free play Teacher Behavior • Promotes fitness • Demonstrates fitness • Instructs generally • Manages • Observers • Other task	Activity level • Lying • Sitting • Standing • Walking • Vigorous
SOPLAY[37]	Middle school	Middle school	Before school, after school, lunch periods	Group	Momentary time sampling Group sampling to scan area Alternate observing boys and girls in areas for each scan • Record number of girls/boys in each activity level • Record predominant activity type for area Record condition for each area prior to beginning scans	Group	Activity types • No specific activity • Aerobics • Baseball/softball • Basketball • Dance • Football • Gymnastics • Martial arts • Racquet sports • Soccer • Swimming • Volleyball • Weight training/lifting • Playground games • None of the above Condition • Area is accessible • Area is useable for physical activity • Area is supervised • Organized PA is occurring in the area • Equipment provided by school or other agency	Activity level • Sedentary • Walking • Very Active
SOPARC[18]	Parks	4-18 years (validation	1 hour observation	Group	Momentary time sampling Group sampling to scan	Group	Condition • Accessible	Activity level • Sedentary

		for activity codes) but observes all people	periods		area. Record condition for each area prior to beginning scans Alternate observing females and males in areas for each scan Conduct 3 scans • 1st--Record # of females/males participating in predominant activity type for area by age and ethnicity • 2nd—record # of males/females in primary activity by activity level • 3rd—scan for secondary activity and spectators		• Useable • Equipped • Supervised • Activity organized • Dark • Empty <u>Activity types</u> • Fitness related (aerobics, jogging/running, strengthening, etc) • Sports related (baseball, basketball, horseshoes, dance, etc) • Active game related (climbing/sliding, jumping, tag/chasing games) • Sedentary related (artwork, chess, picnicking, reading) <u>Age group</u> • Child • Teen • Adult • Senior <u>Ethnicity</u> • Latino • Black • White • Other <u>Participants</u> • # of participants in primary activity <u>Spectators</u> • # of spectators at event, activity being watched, spectator characteristics	• Walking • Very Active
SOCARP[20]	Recess	Elementary schools	Total recess time	Individual	<u>Momentary-time sampling</u> 10 second observe, 10 second record	Focal child	<u>Group Size</u> • Alone • Small • Medium • Large <u>Activity types</u> • Sports • Playground games • Sedentary activities • Locomotion <u>Interactions</u>	<u>Activity level</u> • Lying • Sitting • Standing • Walking • Vigorous

							• Prosocial physical • Prosocial nonphysical • Antisocial physical • Antisocial nonphysical • Ignore	
SOSMART[22]	Classrooms	Elementary	1.5 hour blocks of time during normal classroom time	Group	Interval Recorders list all relevant codes present during continuous 20 second interval observation	Group	Teacher Direct • Classroom teacher • Other • None Instruction • Teacher-led • Technology-led Movement Type • Reward/Incentive • Opening Activity • Teacher Directed Transition • Other Movement (non-academic) • Other Movement (academic) Students active as a result of what • Physical Environment • Non-Teacher Directed Transition	Students Active (SA) • Whole class • Part class • Small group • None
SOSPAN[25]	After-school programs, summer day camps	Grades K-5	Entire program and camp duration	Group	Momentary time sampling Scan sampling 3 minutes • 7 sub-scans; 3 staff behavior scans, 2 staff management scans 2 context scans	Group	Activity Context • Scheduled activity • Grade level of children • Location of activity • Equipment available Staff behaviors • Supervise • Other task • Off task • Physical activity instruct/lead • Physical activity engaged • Physical activity promote • Physical activity discourage • Physical activity withhold • Staff eating • Staff drinking Staff management	SOPLAY

							• Staff giving instructions • Staff disciplining children • Idle time • Children stand and wait-in-line for turn • Elimination game • Choice provided • Physical activity unsafe • Small sided game • Rules modified for physical activity	
SOHO[15]	youth sport	9-10	Total practice time	Group	Momentary time sampling 10 second observe, 10 second record PA, lesson context	Focal child • Choose 4 children and one alternate Follow each child for 4 minutes then rotate to the next child	Lesson context • General content • Knowledge • Fitness • Skill practice • Game play • Other	Activity level • Lying • Sitting • Standing • Walking • Vigorous
OSRAC-P[26]	Preschool	Preschool	30 min observation block	Individual	Momentary time sampling 5 second observe, 25 second record	Focal child	Activity type • Climb • Crawl • Dance • Jump/skip • Lie down • Pull/push • Rough and tumble • Ride • Rock • Roll • Run • Sit/squat • Stand • Swim • Swing • Throw • Walk • Other Location • Inside • Outside • Transition Indoor Activity Codes • Art • Preacademic	• Fast • Moderate • Stationary

							• Gross motor • Group time • Large blocks • Manipulative • Music • Nap • Self-care • Snacks • Sociodramatic • Teacher arranged • Time out • Transition • Videos other <u>Outdoor activity context codes</u> • Ball and object play • Fixed equipment • Games • Open space • Pool activities • Portable equipment • Sandbox • Snacks • Sociodramatic props • Teacher arranged • Time out • Wheel • Other <u>Activity initiator codes</u> • Adult • Child <u>Group Composition codes</u> • Solitary • One-to-one adult • One-to-one peer • Group adult • Group child <u>Prompt codes</u> • No prompt for PA • Teacher prompt to increase PA • Teacher prompt to decrease PA • Peer prompt to increase PA • Peer prompt to decrease PA	

OSRAC-YS[14]	Youth sport	7-14 years	Total practice time	Individual	Momentary time sampling 10 second observe, 20 second record Observe child for 10 minute block, then rotate to next child. Continue until end of practice	Focal child	Practice context • Warm-up • Drills • Tactic/Instruction • Fitness • Game • Cool-Down • Transition Social Context • Individual • 1 vs 1 • Small group • Full team Coach behavior • Watching with verbal feedback • Watching without verbal feedback • Demonstration • Management/general instruction • Disengaged/off task Coach proximity • Proximal to the child • Distal to the child	• Stationary/motionless • Stationary with movement of limbs or trunk • Slow/easy movement • Moderate movement • Fast movement
OSRAC-E[33]	Elementary schools	K-5th	20 minute observation period	Individual	Momentary time sampling 5 second observe, 25 second record Observe child for 10 minute block, then rotate to next child. Continue until end of observation period	Focal child	Activity type • Climb • Crawl • Dance • Jump/skip • Lie down • Pull/push • Rough and tumble • Ride • Rock • Roll • Run • Sit/squat • Stand • Swim • Swing • Throw • Walk	• Stationary/motionless • Stationary with movement of limbs or trunk • Slow/easy movement • Moderate movement • Fast movement

							• Other Location • Inside • Outside • Transition Physical setting • Cafeteria • Classroom • Gym • Hallway • Library • Multi-purpose • Playground • Sports field • Other inside • Other outside Instructional Setting Codes • Art • Assembly • Before school • Computer • Core class • Dance • Lunch • Media Arts • Music • PE • Recess • Other related arts • Other Activity Context Codes • Academics • Ball/object • Class business • Computer • Fixed • Game • Gross motor • Open space • Rest • Sandbox • Self-care • Snacks • Sociodramatic • Teacher arranged	

							• Time out • Transition • TV/Video • Wheels • Other <u>Activity Initiator</u> • Adult • Child <u>Group Composition</u> • Solitary • 1-1 Adult • 1-1 Peer • Group adult • Group Child <u>Prompt for activity code</u> • No prompt for PA • Adult prompt to participate in PA • Adult prompt to decrease PA • Peer prompt to engage in PA • Peer prompt to decrease PA	
OSRAC-H[17]	Homes	Preschool (mean age=4.5yrs)	30 minute observation	Individual	<u>Momentary time sampling</u> 5 second observe, 25 second record	Focal child	<u>Activity type</u> • Climb • Crawl • Dance • Jump/skip • Lie down • Pull/push • Rough and tumble • Ride • Rock • Roll • Run • Sit/squat • Stand • Swim • Swing • Throw • Walk • Other <u>Location</u>	• Stationary/motionless • Stationary with movement of limbs or trunk • Slow/easy movement • Moderate movement • Fast movement

							• Inside • Outside • Transition <u>Indoor activity context codes</u> • Computer • Education • Games • Gross motor • Housework or chores • Music • Parent arranged • Pets • Rough and tumble • Self-care • Snacks • Sociodramatic • Time-out • Transitions • TV or videos • Video games • Other <u>Outdoor activity codes</u> • Ball or object • Fixed equipment • Game • Open space • Outside chores • Parent arranged • Pets • Pool • Portable • Rough and tumble • Sandbox • Self-care • Snacks • Socioprops • Time-out • Video games • Wheel Other <u>Activity Initiator</u> • Adult • Child <u>Group Composition</u> • Solitary • 1-1 Adult	

							• 1-1 Peer • Group adult • Group Child <u>Prompt for activity code</u> • No prompt for PA • Adult prompt to participate in PA • Adult prompt to decrease PA • Peer prompt to engage in PA • Peer prompt to decrease PA <u>Engagement codes</u> • None • Adult • Peer • Adult and peer <u>TV use codes</u> • Off • On • Not applicable	
CAST[34]	Recess Lunch	K-6	Duration of recess and lunch	Group	<u>Momentary time sampling</u> Scan Sampling Alternate observing boys and girls in areas Repeat 2 scans of area every 75 seconds • 1st scan for PA, • 2nd scan for equipment or teacher	<u>Group</u>	<u>Equipment availability/used</u> • # of balls in area • # of children playing ball game • # of children with nonfixed equipment other than balls • Number of children playing on fixed equipment <u>Teacher presence/absence</u> • # of teachers present in area • Number of teachers encouraging PA • # of teachers observing • # of teachers managing	• Lying • Sitting • Standing • Walking • Vigorous

FATS[32]	Home	1-4 years	90 minute observation period/60 minute observation period	Individual	Interval sampling Observe 10 seconds, record 10 seconds	Focal child (parent)	Child behavior • Sleeping • Lying down • Sitting upright • Crawling • Climbing • Standing still • Walking • Running Physical location • Bedroom • Living room • Kitchen • Bedroom • Front or back yard Agent • Mother • Father • Sister • Brother • Grandmother • Grandfather • Other relative • Babysitter/caretaker Form of interaction • Physical encouragement • Verbal encouragement • Physical discouragement • Verbal discouragement	• Minimal • Moderate • Extreme
SOTG-PE	PE	11-16	Total PE class	Group	Partial interval 10 second observe, 10 second record • Teacher behavior Momentary time sampling 10 second observe, 10 second record PA, lesson context	Focal child • Choose 4 children and one alternate Follow each child for 4 minutes then rotate to the next child	Lesson context • Warm-up • General Management • Technical practice • Applied skill practice • Modified game • Small-side game • Full game • Free play • Other Teacher interactions • Verbal technical behavior • Non-verbal technical behavior • Verbal tactical behavior • Non-verbal tactical	• Inactive • Motor response • Locomotion • Motor/locomotion • Mot/locomotion off task

							behavior • None	
Behavior Mapping[36]	Preschool centers	Preschool	Outdoor time	Group	Scan Record each child and each child's activity level on a map Collect 4 maps/observation period	Group	Location *specific to outdoor area, examples include • Dramatic play • Gathering area • Open area • Pathway • Play equipment • Porch/transition • Sand play	• Stationary/motionless • Stationary with movement of limbs or trunk • Slow/easy movement • Moderate movement • Fast movement
PARAGON[19]	Garden	Elementary	60 minute period	Individual	Momentary time sampling 15 second observe, 15 second record	Focal child	Garden task • Cleaning • Carrying • Digging • Harvesting • Watering • Planting • Weeding • Resting/observing • Other Garden motions • Bending • Gripping • Stretching • Lifting • Pushing/pulling • None Social associations • No other children • Other children • Other adults • Parent/Family • Teachers Overall interactions	• Lying • Sitting • Standing • Walking • Vigorous • Kneeling • Squatting

							• Promoting PA • Inhibiting PA • None	

Appendix B - Coding Scheme, Definitions, and Examples for Each Contextual Variable of the Observation System

	Code	Definition	Example
Task		**The purpose of the segment.**	
	Warm-up	Time devoted to a routine execution of physical activity with a purpose to prepare the individual for engaging in further activity, but not designed to alter the skill or fitness of the individual on a long-term basis. Usually occurs in the beginning of practice.	At the beginning of practice the coach has kids do a serious of dynamic warm-ups and stretches as a group (high knees, lunges, butt kicks, etc.)
	Free play	Time during which adult influence of task choice is not intended.	The coach has footballs for the kids to play with at the beginning of practice but does not tell the kids what activities to do or not to do.
	Fitness	Time where major purpose is to alter the physical state in terms of cardiovascular endurance, strength or flexibility.	Running sprints
	Sport Skill	Adult-led activity time devoted to practice of skills with the primary goal of skill development.	Passing drills, flag grabbing drills
	Game play	Adult-led time devoted to playground games where skills are not directly applicable to a competitive sport game and there is little to no adult instruction or feedback.	Tag, sharks and minnows
	Scrimmage	Adult-led activity time devoted to the refinement and extension of skills in a sport game where two opposing teams are created within a team. Minimal interference from the coach.	Within a team, the kids are playing a mock football game
	Strategy	Time devoted to transmitting information related to rules and strategy of the sport.	Putting in or practicing an offensive play, defensive system, etc.
	Management	Time allocated to managerial and organization activities, time devoted to team business that is unrelated to instructional activity.	Time out, opening huddle, closing huddle
	Self-care	Time devoted to washing, using the rest room, or drinking water.	Water break
Member		**The arrangement of the setting members within an**	

Arrangement	**segment.**	
Solitary	Child is doing activity alone.	During a dribbling drill, the child is practice by him or her self.
One v One	Child is doing activity with only one additional participant [9].	During a blocking drill, each child has a partner and they take turn blocking.
Small group	Child is performing an activity with greater than one other child, but less than the full team.	During a receiving drill, the full team is split into two groups. Each group has their own drill to complete, and the groups are not working together.
Whole group	All children are participating in an activity.	All kids go to water break at the same time.
Setting Demand	**Population distribution that influences the system**	
Optimal	Time period when there are an equal number of opportunities to participate as children to participate (i.e., fosters participation).	During tag all 7 kids are playing at the same time, during warm-up all the kids are on the line at the same time
Disadvantaged	Time period when there are a fewer number of opportunities to participate than children available to participate (i.e., fosters exclusion).	During tag, if you get tagged you have to sit on the sideline until all of the children are out. During a passing drill, only 1 child is receiving the pass at a time, the rest are waiting in line behind him.