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TIER CHANGE PROFILES:

A LONGITUDINAL EXAMINATION OF STUDENT STRENGTHS AND RISKS

IN AN INTEGRATED STUDENT SUPPORT INTERVENTION

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Tier Change Profiles: A Longitudinal Examination of Student Strengths and Risks in an Integrated Student Support Intervention

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Poverty negatively impacts health, emotional wellbeing, and educational outcomes for children and creates an opportunity gap between children living in poverty and their wealthier peers (American Academy of Pediatrics, 2016). To close the opportunity gap, schools are encouraged to adopt a systemic approach that addresses both academic and non-academic barriers to learning (Adelman 2018). Integrated Student Support (ISS) models have emerged as one of the most effective systemic school-based interventions (Moore et al., 2018).

ISS interventions use various strategies to address the continuum of student needs. Tiered intervention frameworks are one strategy geared towards categorizing risk levels and services by their respective levels of intensity. Tiered interventions commonly focus on academic and social-emotional domains. However, their social-emotional focus is often limited to behavior and their categorization of students is deficit-focused (Freeman et al., 2017).

City Connects, one ISS intervention implemented in high-poverty urban districts, uses a tiered intervention framework that encompasses the whole child and incorporates strengths as well as risks. City Connects assigns a tier to strength/risk levels evidenced by students at the beginning of each school year. While City Connects has demonstrated robust positive effects on student outcomes, little is known about annual tier level.

In the current study, repeated measures latent class analysis (RMLCA) identified patterns of tier change over five years during which students attended City Connects elementary schools in one district. Multinomial regression and chi-square analyses investigated the relationship of social-emotional strengths, needs, and services to the Tier Change Profiles.

Overall, more than half of students changed tier between time points. The most commonly exhibited tier change was increasing/decreasing tier by one. RMLCA findings indicated that students facing lower risk at baseline, exhibited low risk over time, while students facing the highest risk exhibited the greatest volatility in risk over time. Students who had more social-emotional strengths than needs were more likely to exhibit Tier Change Profiles of low risk over time but having more social-emotional needs than strengths was not predictive of Tier Change Profile. Among other findings, outcomes suggest that acknowledging and bolstering strengths play a significantly positive role in developmental trajectories.

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Chapter 1: Introduction

It has been well established that child poverty is associated with risk factors that deleteriously impact physical health, emotional wellbeing, and educational outcomes for children immediately, and long-term (Brooks-Gunn & Duncan, 1997; Coleman, 1966; Dearing, 2008; Engle & Black, 2008; Rothstein, 2010; Walsh & Brabeck, 2006). Many researchers suggest that the number of risks a child is exposed to is cumulative, leading to increasingly negative outcomes the higher the level of risk (Ingram & Price, 2001; Juster et al., 2011; Sameroff, 2009).

School-Based Intervention

Given that schools are one of the primary contexts of development for the vast majority of children in the U.S., they have been targeted in the national reform efforts to reduce the negative impacts associated with child poverty. School-based interventions have focused primarily on academic achievement (Walsh & Murphy 2003). Over time, school-based interventions have increasingly addressed more than just a child's academic success. This shift to a focus on both academic and non-academic risk factors (e.g., social-emotional factors), especially for students living in poverty, largely followed research recommendations that demonstrated the significant role that non-academic factors play in school success. For example, it is now widely recognized that up to two-thirds of the variance in academic outcomes is impacted by out-of-school risk factors caused by societal inequality (Duncan & Murnane, 2014; Rothstein, 2010). Critically for this study, Integrated Student Support (ISS) interventions are

one such, evidence-backed, school-based intervention that emerged in response to this demonstrated need to address the "whole child". ISS interventions have been shown to effectively and holistically address the in and out of school needs of children living in poverty (Moore & Emig, 2014; Moore, et al., 2018).

Tiered Systems of Support

Developmental science has illuminated that risk factors do not impact every child in the same way (Cichetti, 2006). In order to better address risk factors associated with poverty in the individualized manner necessary, Integrated Student Support Interventions (ISS) and other educational interventions have used tiered frameworks often referred to as Multi-tiered Systems of Support (MTSS) to target interventions to individual students according to their level of risk (McIntosh & Goodman, 2016).

Most tiered intervention tools that are characterized as utilizing the MTSS framework, focus on one or few developmental domains (e.g., Response to Intervention (RtI) focuses on academics (IDEA, 2004; Gamm et al., 2012), and School Wide Positive Behavior Intervention and Support (SWPBIS) focuses mainly on behavior (Sugai & Horner, 2009a)). However, MTSS is not one brand of prevention or intervention. Instead, it is a classification framework for educational and a host of other profession-specific intervention and prevention systems that use multiple tiers (usually three) to categorize services into categories (tiers) of the risk level which the services address. To capture the variable nature of these programs that are often conflated into one system through

the use of the term MTSS, the term "tiered intervention tool(s)" will be used throughout the current dissertation.

The necessity to meet a continuum of risks through provision of both prevention and intervention services is a core concept in various educational reforms and theories (Adelman & Taylor, 2006; Marx et al., 1998) but tiering of prevention and intervention tools, programs, and approaches did not begin in education or with MTSS. Tiers have been used in public health for many years and are therefore adaptable to assess risk factors that aren't strictly academic in nature, a key ingredient of a tool to be used towards meeting the academic *and* non-academic needs of children in schools (Corish et al., 2004; Elias et al., 2018; Hassink, 2009; Nemeroff et al., 2008). City Connects, the ISS intervention of focus in the current dissertation, expanded upon more strictly school-based risk foci and created a holistically focused tiered intervention tool.

City Connects

While many extant tiered models in education use tier to categorize the intensity of an intervention (i.e., level of risk the intervention is suitable for) in one or two domains (e.g., academics and/or behavior), City Connects uses tier to categorize service intensity as well as to categorize student levels of *strengths* and risks, and does so across *four* developmental domains (family, social-emotional, health, and academic).

City Connects is the only intervention to date that uses a tier system to assign tier ratings to services and separately, to student strength/risk levels, as well as to take into account student strengths in addition to their risks. This

assessment of strengths/risks in four developmental domains is in alignment with developmental science that indicates that strengths are just as critical to healthy development as risks, and that there are complex interactions between strengths and risks across developmental domains and contexts a child inhabits (Lerner, 1995; Lerner, 2004; Masten, 2011; Masten & Tellegen, 2012; Walsh et al., 2002; Walsh et al., 2014).

City Connects Outcomes. Since its initial implementation in 2001, City Connects has been increasingly implemented in schools around the United States and has demonstrated short and long term positive impacts on school achievement (e.g., higher report card scores and standardized test scores in elementary school) - impacts that have been shown to persist into children's' middle and high school years even after children have left their City Connects elementary school; narrowing achievement gaps between English language learners (ELL) and native English speakers, as well as between immigrant and non-immigrant students; higher rates of postsecondary enrollment and completion for students who attended City Connects schools in elementary school) as well as on student behavior and well-being (e.g., stronger academic effort in grades three through five, lower rates of dropout in high school after attending a City Connects elementary school, lower rates of in-grade retention, lower rates of absenteeism) (City Connects, 2010; 2012; 2014; 2018; 2020; Dearing et al., 2014; Walsh et al., 2014).

These results demonstrate the positive impact of City Connects on all students - high achieving students as well as students characterized as higher at

risk for school failure and drop out. Further, the longer a student attends a City Connects school, the bigger the positive impact of the intervention (Dearing et al., 2016; Walsh et al., 2014). In one study, these positive impacts were found to be equal in magnitude to the negative effects of poverty (City Connects, 2010). The City Connects tiered intervention tool and its related processes are critical towards effective intervention delivery and these positive outcomes.

The City Connects Tier Rating Process. Tier ratings are assigned to student strength/risk levels during a City Connects process called "Whole Class Review" (WCR) during which each and every child is assessed in terms of strengths and risk in academic, social-emotional, health, and family domains. Tier 1 rating corresponds to students who evidence strengths and minimal risks, Tier 2 rating to students with strengths and moderate risks (broken down into Tier 2A (strengths and mild risks) and Tier 2B (strengths and moderate risks)), and Tier 3 rating, to students with strengths and intensive risks. In other words, the higher a student's level of apparent risk, the higher their rated level on the tier categories. Based on this tier level assessment/rating, students are connected with prevention and intervention services across their home, school, and community contexts (City Connects 2012; Walsh et al., 2014).

All students can receive services from Tier Level 1. Students whose risk level is rated at Tier 2 should receive services from Service Tier Level 2 and can also receive services from Service Tier Level 1. Students whose risk level is rated at Tier 3 can receive services from Service Tier Levels 1, 2 and should receive services from Service Tier Level 3 (City Connects 2012; Walsh et al., 2014).

Taken together, each student is linked with a set of prevention, intervention, and enrichment services that are balanced. Services both meet students' average intensity of need while remaining flexible in order to be able to build upon strengths and meet varying levels of needs across domains.

City Connects researchers have looked at tier in a cross-sectional manner and demonstrated that tier rating assignment of students aligns with number of services delivered. In other words, students at highest risk receive the greatest number of intervention services, as would be expected (City Connects, 2012; Walsh et al., 2014). However, there is limited understanding of whether/how tier rating assignment changes over time for a child who is in the intervention.

Proposed Study

Problem

Poverty fundamentally impacts a child's ability to grow and thrive, an impact that is compounded over the lifespan (Duncan & Murnane, 2011). A comprehensive, and systemic approach is necessary to address both the in and out of school risk factors that children living in poverty face. Further, an approach is required that is based in developmental science and can therefore account, in terms of both theory and research, for the complex and multifaceted impact of poverty on individuals as well as the impact of social-emotional risk factors on academic achievement (Adelman & Taylor, 2006; Marx et al., 1998; Walsh et al., 2002; Sameroff, 2009).

ISS interventions are increasingly being cited as school-based initiatives with the evidence-based characteristics necessary to improve child achievement

and outcomes (Moore & Emig, 2014; Moore et al., 2018). ISS interventions rely on a number of tools to successfully meet the needs of children in schools. Tiered intervention tools have been one such critical tool, towards assessing and categorizing levels of risk that each student experiences and thereby individualizing prevention and intervention services. However, tiered intervention tools that address the "whole child" have not been common, consistent, or well established in the intervention literature, especially in their use over time. In parallel, school-based efforts to meet the needs of the "whole child" through assessing and addressing social-emotional needs have been limited in their scope and enacted in isolation of other developmental domains and contexts (e.g., family domain and/or home context). This study explores the longitudinal patterns of student tier levels/rating (Tier Change Profiles) within the City Connects intervention, as well as how varying profiles of strengths, needs, and services in the social-emotional domain impact these patterns while accounting for strengths and needs in family, health, and academic domains.

Problem Statement

City Connects is one of the most quickly growing, long-standing, and well-documented ISS interventions to date. In the recent literature, it has been cited as one of few evidence-backed and cost-effective ISS interventions as demonstrated by rigorous internally and externally driven evaluation studies (Moore et al., 2017). Most importantly, the academic impacts of City Connects on children who live in poverty and are therefore at greatest risk for academic failure, are significant and consistent across differing sites.

As part of its intervention implementation, City Connects uses a unique tiered intervention tool, to holistically assess each and every child across multiple developmental domains. The tiering process is repeated every year for every child and is unique from other tiered intervention tools that solely focus on academic or behavioral risk factors and often assign services to a tier but do not assign a holistic tier to students. While the short- and long-term outcomes of students who receive the City Connects intervention are well documented, and the positive association of tiers with other critical indicators have been validated (e.g., number of services and intensity of services) there has been no study of how individual assignments of the tier rating of a student's risk/strength change longitudinally.

The Current Study. The current study sought to fill this gap in knowledge about the City Connects tier by way of examining the annual tier rating assignments of students over time. Ultimately, a longitudinal study on City Connects tier could illuminate whether there are existing patterns in strengths and risks over time, and further enrich developmental theories. Changes in risk/tier over time could also further knowledge about the impacts associated with City Connects. Additionally, while tiered intervention tools have been increasingly used to serve student's social-emotional needs, the research on the interplay between tier and social-emotional factors is limited. Therefore, the current study explores variability in Tier Change Profiles as they relate to social-emotional strengths, risks, and services. Findings might offer a deeper understanding of a holistic tiered intervention tools with potential applicability for other ISS and school-based interventions alike.

Research Questions. This dissertation will examine tier rating assignments over multiple years that a student is in the City Connects intervention. This is the first study of its kind on City Connects tier and therefore the first research questions will be exploratory in nature while the latter research question more specifically address the impact of social-emotional strengths, needs, and services on tier trajectories. Hypotheses will be stated at the end of Chapter Two.

Research Question 1: *Do the annual tier ratings/risk levels (Tier 1, 2a, 2b, and 3) of individual students change between first and fifth grade time points? What is the average number of times a student changes tier out of four possible changes between each of the five, time points? On average, what is the number of tier levels (-3, -2 ,-1, 0, +1, +2, or +3) that change between time points and in what direction is the change (increasing or decreasing tier of risk) ?*

Research Question 2: *Are there characterizable patterns of holistic tier ratings (Tier Change Profiles) over the course of the five sequential, elementary school years included in the current sample such that there are discrete subgroups of students who have similar tier ratings at the same time points and similar direction of tier change (increase or decrease in tier) as well as intensity (number of levels of tier change) of tier change between timepoints?*

Research Question 3: *Do students' number of identified social-emotional strengths and needs and number of social-emotionally focused services significantly impact their Tier Change Profiles (i.e., characterized pattern of tier ratings and tier change) over the course of five years?*

Chapter 2: Literature Review

Poverty's Impact on Child Development: A Public Health Crisis

Poverty is one of the most persistent, widely acknowledged, well researched, and prominent risk factors for negative life outcomes. These outcomes are particularly visible and concentrated in America's urban centers where the concentration of people is highest. For children, the impact of poverty is especially profound, given that the risk for negative life outcomes associated with poverty drastically increases the earlier a person is exposed to poverty and the more prolonged their exposure lasts (Duncan et al., 1998; Hughes & Tucker, 2018; Jensen et al., 2017). Children who are born into families living below the poverty line are more likely to experience serious and maladaptive life outcomes like higher rates of mental health illnesses, incarceration, drug and alcohol use, and most strikingly, higher rates of early mortality (Evans & Cassels, 2014; Leventhal & Brooks-Gun, 2000).

Pertinent for this study, child poverty is commonly linked with higher rates of school dropout and failure, an outcome that has been frequently referred to as the "achievement gap"' the persistent gap in academic outcomes between Students of Color and their White peers (American Academy of Pediatrics, 2016; Child Trends, 2019; Putnam, 2015; Reardon, 2013). Given the link between poverty and negative academic outcomes, the "achievement gap" has come to be known as the "opportunity gap" to more accurately capture the economic inequality that is proven to be the source of this difference (Bailey et al., 2017;

Darling-Hammond, 2014; Milner, 2013; O'Brien et al., 2020; Roy & Raver, 2014).

While the "opportunity gap" most commonly pertains to educational achievement, researchers have noted a significant gap in access to support in almost all areas of development including mental health, physical health and family well-being (O'Brien et al., 2020). While some authors refer to these gaps by a different name such as the "mental health service gap", the "opportunity gap" can also be used to explain this gap in access to services in these other domains. For example, the "mental health service gap" is due to the under-resourcing of prevention and intervention systems for social-emotional wellbeing in impoverished neighborhoods (Alegria et al., 2015; O'Brien et al., 2020). Given this gap in access to resources, there is an increased likelihood of mental illness, incarceration, unemployment, homelessness, and other immediate and long-term impacts, for children who grow up in poverty, a finding that is amplified for poor Children of Color due to their experiences of discrimination in addition to poverty (Alegria et al., 2015; Breslau et al., 2005; Farmer & Ferraro, 2005; O'Connell, Boat, & Warner, 2009). It cannot be overstated that these academic, health, family and social-emotional/mental health outcomes should be viewed as related and contextualized through an understanding of oppression and poverty's impact on development.

Given the immediate and long-term, well-documented, impacts of poverty on life outcomes in multiple life domains, especially when exposed early in life, poverty has been recognized as a national public health crisis for decades and

thereby has been addressed through a variety of public health initiatives at the local and national levels (Berliner, 2009; Brooks-Gunn & Duncan, 1997; Coleman, 1966; Evans & English, 2002; Freudenberg, 2000; Gershoff et al., 2003; Kiser, 2009; Roy & Raver, 2014). Many of these interventions have targeted children and families, not only because of the known cumulative impact of poverty when exposure starts early in life, but also because of the demonstrated increased likelihood of success when interventions are implemented early in a person's life (Cates, Weisleder, & Medlsohn, 2016; Kenny & Tsai, 2020; Ramey & Ramey, 1998).

In sum, the impacts of poverty, are known to be many, are thought to be associated, and to be compounding. Therefore, living in poverty has been accepted as a major "risk" factor for numerous negative outcomes in family, social-emotional, health, and academic domains. The concept of "risk" has been defined in the literature as a measurable factor that is associated with an outcome and can be variable across people and contexts, as well as variable in terms of its nature (e.g., stable vs unstable risk factors) (Kraemer et al., 1997). While researchers agree that poverty is a major risk factor for all children, there is also significant evidence to suggest that there is significant variability between children in the expression of poverty-associated outcomes. In other words, no two children respond to the risk factors associated with poverty in the same way due to a host of biological and contextual factors.

For example, genes that regulate stress can be impacted by patterns of maternal care which can lead to differing neural development and mental health

outcomes for children exposed to the same context of poverty (Meaney, 2001). In order to account for this variability, models that attempt to explain and/or "treat" the negative risk factors associated with poverty must be able to address significant complexity. In this chapter, theories and models relevant for assessing and addressing the complex and interconnected factors associated with child poverty are explicated.

Theoretical Bases

Key Developmental Theories and Concepts

In order to be most effective, interventions must be based in theory and research. In order to be most effective for children in particular, it is critical that interventions be grounded in developmental science (Walsh et al., 2002). In order to adequately "treat" risks of all kinds, the general and specific impacts of risk on development must be understood**.** The overarching theories and concepts that are pertinent for understanding City Connects, the developmental science-grounded intervention of focus in the current study are, (1) Cumulative Risk Theory, (2) Transactional models of development, (3) Developmental domains and contexts, (4) Developmental Cascade, and (5) Risk, resilience, and prevention science. These core concepts, their related theories, and their implications for interventions will be described in the following sections along with their relevance for school-based interventions.

Cumulative Risk Theory. Early developmental research provides one theory that seeks to integrate poverty's varying and cumulative risk factors. This theory is Cumulative Risk Theory and has been widely accepted across various

fields of study (e.g., medicine, psychology, policy). Cumulative Risk Theory states that the greater the number of poverty-associated risk factors (e.g., parental unemployment, single parent home, low level of parental education) a child is exposed to, the more negative outcomes one can expect for that child. (Appleyard et al., 2005; Evans & Whipple, 2013; Rutter, 1979; Sameroff, 2009; Sameroff et al., 1998). More specifically, research has shown that the number of poverty-associated risk factors a child is faced with, the more negative impacts that same child experiences on their social-emotional and cognitive development. This finding has clear implications for the academic outcomes (e.g., school failure and school drop-out) and relational outcomes (e.g., increased likelihood of engaging in abusive relationships) for children who grow up in poverty. Given the increase in negative outcomes that comes with increased risk, it would be prudent for interventions to assess the quantity of risk students face as well as to more intensely target children who face more significant risks (Ackerman et al., 1999; Garmezy, 1993; Rutter, 1990; Sameroff et al., 1993).

Transactional models of development. Cumulative Risk is one theory that addresses the negative impact of increased risk, in other words, the quantity of risk. However, Cumulative Risk does not address the interplay between risk and other factors of development, or even how the same risk factors might impact individuals in different ways. Therefore, while it is helpful, it is not complex enough to be sufficient. Additional theories are needed in order to assess the impact of risk on development.

Transactional models of development consider both the individual as well as the environment (including the known external risk factors associated with the environment), and propose that there is a bi-directional impact between the two.

This transactional understanding of development allows for individual variation while continuing to appreciate the generalizable negative impact of certain risk factors and circumstances like poverty (Sameroff, 2009). Further, the transactional model is dynamic over time, suggesting that it is not sufficient to identify individual and contextual factors and their interplay at one time point. Instead, to fully understand development, one must look at the interplay of these factors over the lifespan (Sameroff 1993; 2006; 2009).

Transactional models of development do not exclusively account for risk factors but rather, consider the whole child, necessitating a consideration of both protective or promotive factors and risk factors (Sameroff, 2006). These factors are not included in models that focus purely on risk and intensity of risk such as Cumulative Risk theory. This consideration of the whole child, rather than taking a deficits/risk-only approach is an approach that has become widely popular in the field of education given the research showing that development is best understood as a product of all factors, internal and external, to a child as well as the interactions and transactions between them. Further, it has been shown that protective factors can actually work against the otherwise negative impacts of risk (Cichetti, 2006; Masten & Tellegen, 2012).

Transactional theories have important implications for interventions. First of all, given the complexity of transactional development, there are multiple time

points that are ripe for intervention in the lifespan of a child. Further, interventions should consistently monitor impacts and adapt to the ever-changing needs of a child overtime. And finally, in order to be most successful, interventions should seek to impact a child across contexts given that a child's development is impacted by interactions across multiple contexts. For school interventions which are of focus in the current dissertation, these theories suggest that school contexts are important but not sufficient if an intervention aims to change the trajectory of development, especially when a child may be experiencing important strength and risk factors both in and out of school.

Developmental Domains and Contexts. The theories that account for the impact of contexts on development stem from Social Ecological Systems Theory, a foundational set of theories that account for the variation in behavior and presentation of a person across contexts (including the self, home, community, country, etc.) and across the lifespan (Bronfenbrenner & Morris, 1998). While broad and seemingly all-encompassing in scope, it can be understood that, development occurs across contexts that a child inhabits (e.g., individual, family, community, school, etc.) as well as within a child's various domains of development (e.g., cognitive, health, family, and socio-emotional-behavioral), and this development occurs continuously over time.

When considered in light of these theories, development is never static and never isolated within one context such as the individual or family or school. Further, as Transactional models of development purport, a child's development in one domain interacts and transacts with development in other domains. This

interaction and transaction across the course of the lifespan creates unique pathways of development for each and every child (Bronfenbrenner & Morris, 1998; Bronfenbrenner & Morris, 2006; Ford & Lerner, 1992; Lerner, 1995; Rutter, 2007; Sameroff, 2009).

When considering the implications of this multi-context and transactional developmental process for a child's academic performance, it becomes clear that academics cannot be considered to be solely influenced by school-based inputs. Practically speaking, this suggests that a child's development must be addressed both in and out of school and encompass as many domains as possible in order to have any real impact on academic development. This is especially poignant in the case of poverty where school performance cannot be considered as distinct from the risk factors that a student may experience in their home and community environments prior to even stepping foot in school in the morning (e.g., food insecurity).

In alignment with this contextually-considerate developmental principle, researchers and policy makers alike have acknowledged the importance of schools collaborating with home and community providers to better address the needs of children across contexts and in multiple developmental domains. This is not to suggest that schools should "do it all", but rather that collaboration between home, school, and community contexts needs to be closely coordinated in order to be sure that as many developmental domains as possible are addressed without duplication of services. In other words, this signifies the need for a systemic and

coordinated approach (Adelman & Taylor, 2011; Walsh & Brabeck, 2006; U.S. Department of Education, 2015; Walsh et al., 2016).

Developmental Cascades. To understand transactional theories and developmental domains/contexts impact longitudinally, they can be best understood alongside the concept of developmental cascades. Developmental cascades is a concept that offers an explanation for the links between qualitatively different variables in disparate parts of the developmental system (Lewin-Bizan et al., 2010).

For instance, a community-based organization that provides free meals may impact the relationship between parent and child. The parent may pick up these meals after work and enjoy them with their child, increasing secure attachment, and healthy physical development. Impacted by this early developmental experience, this child may have an increased likelihood of maintaining healthy relationships into adulthood. When considered in the context of overall development, it can be stated that factors that exist in various contexts at various timepoints and have varying levels of interaction with the individual, covary and vary independently, to create a highly individualized and interconnected picture of development. There may be some combinations of factors that push an individual towards positive development while other combinations stifle healthy development and lead to maladaptive outcomes. (Lewin-Bizan et al., 2010; Lerner, 2009, Lerner et al., 2009).

With this framework in mind, it becomes incredibly important for school systems to take a holistic approach for each child and for the school environment

as a whole. It also becomes necessary to consider every single child as opposed to only the children most at need, to increase the likelihood that all students will thrive. While developmental cascades theories do suggest a sense of responsibility for any and all actors and factors in development, they also provide evidence that the impacts of intervention can be cumulative and that no step towards change is isolated or meaningless. If anything, schools have the potential to have substantive and robust impacts over the course of childhood and adolescents that will inevitably impact that child's path into the foreseeable future (Adelman, 2006, 2018; Lewin-Bizan et al., 2010; Lerner, 2009, Lerner et al., 2009).

Risk and Resilience. Early public health interventions aimed at buffering against poverty's negative impact were focused on addressing risks. However, it has since been shown, that children exposed to poverty, even those exposed to the same poverty-associated risk factor (e.g., food insecurity), experience varying outcomes, a concept that is known in the developmental psychopathology literature as "multifinality" (Cichetti, 2006; Meany, 2001). While some of this variation in outcomes has to do with epigenetic processes (i.e. gene by environment interactions), some can be due to context, and some of the variation has also been explained by the significant variation in strengths across children.

Strengths are dynamic and may or may not be context-dependent. A child's strengths could be associated with a child's personality (e.g., positive outlook), immediate family (e.g., musical interests) or larger community (e.g., strong community coherence). Most importantly, every child has strengths and longitudinal studies reveal that child strengths can buffer against risk factors

(Center on the Developing Child, 2016; Luthar & Cichetti, 2000; Masten & Tellegen, 2012).

This interplay between strengths and risks can lead to differing outcomes for children who, on the surface, might experience similar risk factors. The interplay of strengths and risks may contribute to "resilience", observed behavior that suggests recovery after a negative experience. Evidence of resilience has led researchers to emphasize the importance of not only identifying and treating a child's risk factors, but also capitalizing on the same child's strengths which can further buffer against risk. Further, by identifying child strengths and working to bolster these strengths, children may also reap psychological benefits such as increased sense of purpose and enhanced self-esteem which can further promote well-being (Center on the Developing Child, 2016; Kenny & Minor, 2015; Masten, 2001, 2011; Masten & Tellegen, 2012; Masten et al., 1988; Rutter, 1979, 2007; Shonkoff, 2010; Ursache & Nobel, 2016).

The transaction or co-action of risk *and* strengths are critical for educators and interventionists to keep in mind, especially, for the most vulnerable youth. Historically, many programs for youth experiencing significant risks solely focused on "treating" risk. In other words, these programs intervene upon an already existing challenge. This reactive, intervention-only approach limits intervention effectiveness given its tendency to ignore strengths. Instead, developmental theory and research suggest the approach of both, treating risk and capitalizing on strengths (e.g., providing students with enrichment opportunities that boost their confidence and build their skills) with the knowledge that these

strengths could buffer the risk (e.g., increased confidence leads to decreased social anxiety).

***Prevention* Science.** Building even further upon their knowledge of the interplay of strengths and risks, researchers suggest an additional step for interventions. Specifically, that in addition to capitalizing on strengths, interventions should also seek to prevent known risk factors before they can occur or be identified. Prevention is not a concept specific to education – it has long been used in public health as a more effective way to manage risk and treat a variety of public health issues (Frieden, 2010; Gordon, 1983; Marx et al., 1998; O'Connell et al., 2009).

Since their early development, prevention approaches have been well studied and validated in the field of education and other fields, and increasingly align with developmental theory. Research has shown that the most successful intervention and prevention programs actually span multiple fields in order to be able to account for numerous developmental domains and multiple contexts – a notion heavily impacted by developmental theories like transactional models of development (Cichetti & Hinshaw, 2002). These programs that both prevent, intervene, and consider risks and strengths are known as "preventive interventions" (Cichetti & Toth, 1991; Cichetti & Hinshaw, 2002; Cowen, 1991; Luthar & Cichetti, 2000; Yoshikawa, 1994).

For example, consider intervention and prevention programs like school-based mental-health awareness programs These programs are often a collaboration between fields of psychology, medicine, and education and are

provided for all students in a school regardless of whether or not they have showed “risky” behaviors (i.e. prevention measures such as suicide screenings), while individual and small group interventions may be simultaneously provided for those who already show risk factors (i.e. intervention measures). Like many other preventive interventions, these mental health preventive interventions have been found to be more successful in both decreasing likelihood of mental health indices and increasing the likelihood that students who have shown risk factors receive the support they need, showing promise for reducing the mental health service gap that parallels the opportunity gap (Horowitz et al., 2010; Mass Levitt et al., 2007; Rickwood et al., 2004; Stockings et al., 2016).

Developmental Theory in Practice: Whole-child Education

Developmental science that emphasizes the importance of multi-context and multi-domain prevention and intervention programs along with research indicating that up to two-thirds of the variability in academic achievement can be predicted by out-of-school (i.e. non-academic) factors (Rothstein, 2010), have led researchers to encourage school-based interventions for children living in poverty to address non-academic, as well as academic, needs of students. This push towards providing a more well-rounded education was amplified by the Every Student Succeeds Act (ESSA), signed into law by the Obama administration in 2015. ESSA not only highlighted the importance of addressing non-academic skills but also provided funding opportunities to do so. (Liew & McTigue, 2010; U.S. Department of Education, 2015; Walsh & Brabeck, 2006; Walsh et al., 2016).

The focus on both non-academic and academic needs that has since emerged has been guided by developmental theories that argue all developmental domains are interconnected and further, that promoting development in a non-academic domain is actually complimentary and promotive of development in an academic domain as well. Thus, the term "whole-child" has increasingly been used to represent the interconnectedness of all domains and the intention to attend to all domains in the field of education and other disciplines alike (Lewallen et al., 2015; Liew & McTigue, 2010; Miller, 2010).

Relevant for this study, "whole child" intervention and prevention programs in the field of education often target urban schools, given their proximity to children who live in poverty and are at higher risk for negative academic and social-emotional outcomes associated with the "opportunity gap". These intervention and prevention programs address the academic and non-academic risk factors for academic failure in an effort to lessen the "opportunity gap" and its associated disparities (Liew & McTigue, 2010; Noddings, 2005). Prevention and intervention efforts that address non-academic risk factors in evidence-based and theory-driven ways often show positive academic results as well as positive impacts on mental health and well-being, further strengthening the support for an approach to education that is guided by developmental science (Berliner, 2009; Cappella et al., 2008; Reinke et al., 2008; Walsh et al., 2014).

Social-emotional Learning in Schools

As is the case with most large scale change efforts, progress towards whole child approaches was slow. In practice, schools have implemented

interventions focused on non-academic barriers to learning to varying degrees and on varying timelines.

A big push towards implementing non-academic interventions was initiated in 2015 after ESSA incentivized districts and schools to do so under the broad umbrella of "social-emotional" interventions. Social-emotional learning/development has variable definitions but in schools, it generally refers to curricula that promote the positive peer relationships, emotion regulation, behavior regulation, and attention/executive function skills that are necessary to be ready for, and successful in, school as well as the long term. It should be noted that while "social-emotional learning (SEL)" in the field of education typically refers to a specific set of evidence-backed intervention curricula implemented in schools (e.g., McClelland et al., 2017), the current section includes formal SEL interventions as one, but not all, of the ways in which schools might focus on social-emotional content. Instead, social-emotional is used to mean the social-emotional developmental domain rather than any specific intervention.

In and out of school settings, social-emotional development has been closely tied to mental health and well-being, factors that are just as important for successful home and work life as they are for educational success (Blair, 2002; Jones & Bouffard, 2012; Kenny & Minor, 2015; Liew & McTigue, 2010; Ramey & Ramey 1988; Raver & Knitzer, 2002). Despite the general consensus on the components included in social-emotional development and its importance for overall healthy development, schools have not focused on social-emotional foci to the same degree. For example, while some schools focus on social-emotional

development by offering lunch groups that promote social skills to students, others have a mandatory class that focuses on social-emotional content, others allocate social-emotional content as an elective course, while others incorporate it into every class in the general curriculum through practices like mindfulness (Domitrovitch et al., 2007; Durlak et al., 2011; Grant et al., 2017). These varied approaches mostly focus on teaching children social and emotional skills rather than addressing social-emotional risks themselves.

Relevant for this study due to their frequent implementation in high poverty inner-city schools, there have been social-emotional intervention efforts to focus on behavior regulation, which is one, but not a comprehensive, element of social-emotional development. These efforts do incorporate a focus on behavioral risks (e.g. running out of the classroom), as well as teaching preventive and positive behavior regulation skills. Behavioral risk factors have been identified as an important target of social-emotional interventions given the clear link between this non-academic domain, success in school, and success in the "real world". For example, it has been found that students with high numbers of disciplinary incidences in school are at greatest risk for a host of maladaptive outcomes (e.g., poor peer relationships, school drop-out, incarceration, etc.) (see Sugai & Horner, 2009).

Proponents of current social-emotional foci in schools, like those that focus on behavior, aim to target school culture alongside social-emotional development in order to be considerate of the individual as well as the context, an approach consistent with social ecological and transactional theories of

development. Also consistent with developmental theory, these varying social-emotional school-based programs and foci are unified by their shared intent to promote mental health and wellbeing through both prevention (e.g., teaching age-appropriate behaviors to all children) and intervention (e.g., mental health counseling for children who have begun exhibiting "problem" behaviors) (Cohen et al., 2005; Darling-Hammond & Cook-Harvey, 2018; Durlak et al., 2011; Raggi & Chronis, 2006). This is especially important for children who live in poverty given the well-known mental-health gap that is caused by the "opportunity gap" (Alegria et al., 2015; Briggs-Gowan, Carter et al., 2001; Cohen, Onunaku, Clothier, & Poppe, 2005).

While some interventions do focus on multiple non-academic domains, most are not comprehensive and conflate a focus on behavior with a focus on social-emotional development at large which encompasses so much more than just the visible behavior a student may exhibit (Durlak & Weissberg, 2011; Grant et al., 2017; Jones & Bouffard, 2012). Still, while efforts are uneven in nature, they have moved schools towards a more developmentally sound approach to education. As schools have increasingly adopted social-emotional foci, they have expanded their non-academic foci, and thereby moved towards addressing more of the whole child.

Further, positive social-emotional health is linked with healthy psychological development more broadly, making programs, informal or formal, that address varying levels of need in the social-emotional domain an important part of any public health prevention and/or intervention addressing poverty

(Catalano et al., 2004; O'Connell et al., 2009; U.S. Public Health Service, 2000). These public health approaches to prevention and intervention will be further explicated in the following section as they pertain to social-emotional development as well as the development of the whole child more broadly.

The Evolution of Tiered Models

Three-Tiered Public Health Models

Research has shown that in order to successfully address public health crises that are as pervasive as poverty, a distinct preventive intervention must be used for differing groups of the population. In other words, public health initiatives must address those who have no current pathology but for whom we are trying to prevent pathology, to those who are showing early signs of difficulty, and finally to those who require treatment because they have already been impacted (Caplan, 1964; Gordon, 1983; Institute of Medicine, 1994). With an issue as expansive and impactful as poverty, preventive interventions have to be complex and comprehensive in order to be successful. It was with this complexity, and both prevention, and intervention in mind, that a three-tier model was developed for targeting varying levels of risk factors associated with issues like poverty.

The three tiers of the original public health model include: *tier one,* for universal prevention initiatives (e.g., universal screenings or educational materials to be distributed to the public), *tier two,* for early intervention (i.e. individuals/groups who had begun showing early signs or symptoms of the problem issues), and *tier three,* for intensive intervention for individuals/groups

who are exhibiting problem issues in their full manifestation. Preventions and intervention services are thereby categorized into corresponding tier groups by their intensity level. One classic example of the tiered public health model in practice is health education delivery in school. Health education is provided to all students in a school to prevent risky behaviors like smoking (tier one) but smaller groups might be formed for students who exhibit early signs of risky behaviors to more directly and intensively address their behaviors (tier two), and for students who may have already tried smoking, smoking cessation materials and one on one counseling for addiction could be provided (tier three) (Frieden, 2010; Gordon, 1983; Marx et al., 1998; O'Connell et al., 2009).

In classic three-tier public health models, tiers categorize intervention services by risk/intensity level; according to the risk level or level of need of an individual, they are connected to a service with an appropriate risk/intensity level (Gordon, 1983; WHO, 2004). Still, individuals may receive services from multiple tiers of intervention and prevention rather than only from the risk/intensity level that matches their own. For instance, in a mental health intervention, mental health education/awareness services are provided to *all* students regardless of level of risk for developing mental health challenges (tier one). However, only a subgroup of those students that are classified as higher at risk for developing mental health challenges receive more targeted and intensive tier two and three interventions in addition to the preventive education. Given their targeted nature and flexibility, tiered interventions can be layered upon one another. The same students who may be receiving tier two and tier three mental

health interventions might only be getting tier one services when it comes to another kind of behavior (e.g., smoking prevention) given their differing risk levels for different issues.

While no single tiered system has sought to address poverty in its entirety for the obvious reason that the impacts of poverty are too vast, too complex, and too systemically entrenched to be addressed by one initiative, many poverty-related risk factors have been addressed via public health tiered preventive interventions (e.g., drug/alcohol use (see Griffin & Botvin, 2011), mental health disorders (see Reinke, Splett, Robeson, & Offutt, 2009)). Importantly, many of these tiered preventive interventions have been targeted towards children given the knowledge that the earlier in life that an intervention and/or prevention is implemented, the more successful the intervention/prevention can be at buffering against cumulative risk factors and their harmful associated outcomes (Blair & Raver, 2016; Ramey & Ramey 1988).

School-Based Tiered Models. In order to organize and target preventions and interventions, schools have borrowed from the public health three-tiered public health model. At first, these tiered interventions took strictly academic foci but since, have moved towards more holistic approaches with the acknowledgement that non-academic factors play a significant role in promoting positive development for school-aged children.

The most widely implemented and studied school-based models of tiered intervention and prevention frameworks will be described in the current section which will illustrate the evolution of tiered frameworks for use in schools. This

evolution also reflects the larger shift in school-based foci from academic to whole child to better align with developmental science.

Response to Intervention. The first widely recognized and formalized tiered prevention and intervention model in education is called Response to Intervention (RtI) and was brought about by the Individuals with Disabilities Education Act (IDEA; 2004). RtI, as it was originally proposed, had three core tiers, modeled closely after the public health prevention and intervention model ((1) Universal prevention (high quality instruction and universal screening), (2) Targeted prevention and intervention (increasing intensity of instruction and potentially decreasing number of students in a learning group), (3) Intensive intervention (individualized intervention, and comprehensive evaluation for potential need of alternative educational setting or program)).

RtI was exclusively focused on academics. More specifically, it provided educators with a tool to better assess and treat students at varying risk for developing learning disabilities. RtI provided an especially important tool to inner city schools that were, and still are often under-resourced and serve high proportions of students in poverty. Prior to IDEA, most of these schools did not have the resources or methods for universally screening and treating students with learning disabilities. Therefore, RtI served as an important tool that had promise for addressing a child's educational needs before they fell through the proverbial crack due to their academic needs being left unmet. Further, it did so in a structured way that utilized pre-existing school resources but changed school processes, which was a critical factor for schools with limited resources. It

therefore proved to be sustainable and popular, quickly spreading across all 50 states in some form or another (Berkely et al., 2009; Bradley, Danielson, & Doolittle, 2005; Fuchs & Fuchs, 2007; NRCLD, 2007b).

Importantly, the RtI model also emphasized high-quality, consistent, and research-based classroom instruction and use of data for close monitoring of students in an ongoing way. This has since become a critical feature of all tiered models for use in schools. While RtI was initially developed to monitor students who might be at risk for developing learning disabilities, because of its systematized and evidence-backed approach, it quickly became adopted by educators who wanted to organize their approaches to other academic areas (e.g., RtI for monitoring students' academic performance in specific subjects like reading).

School Wide Positive Behavior Intervention and Support. While RtI provided schools with systematization and organization they were craving, it only encompassed academics. Therefore, as schools shifted their foci towards addressing the impact of non-academic, as well as academic needs, RtI shifted in focus and name to capture the shift towards the non-academic. Behavior was the first non-academic domain upon which school-based tiered intervention models focused. While these models were initially still called RtI in the literature, they eventually transitioned to being called "effective behavioral support" as they broadened their foci to non-academic domains (Kelly et al., 2010), and finally, the behaviorally focused tiered model that is most often implemented today, School Wide Positive Behavior Intervention and Support (SWPBIS) (Allen & Steed,

2016; Algozzine et al., 2014; Fallon et al., 2012; George et al., 2013; Horner et al., 2010; Sugai & Horner, 2006; Vincent & Tobin, 2010).

Tiered Systems of Support – an Organizational Approach to Intervention. As RtI and SWPBIS grew in their popularity and use, other tiered intervention models were also developed with varying foci and scopes. It became clear that for schools, the public-health three-tier model was more of an organizational approach or strategy rather than adoption of any specific intervention. As school-based tiered models gained momentum across the United States, various alterations were made to both the structure of the original three-tier public health system (e.g., adding to the number of tiers), and to the content of focus (e.g., social-emotional learning more broadly rather than just behavior) (Berkely et al., 2009; Freeman et al., 2017). Some schools focused efforts on one tier of prevention and intervention (e.g., implementing a universal screening at tier one given the lack of prevention services in that school) to bolster their current approaches (Jones et al., 2012), while others implemented interventions at all three (or more) tier levels (Lane et al., 2013). Despite their clear differences from RtI and SWPBIS, many schools continued to call their tiered models RtI and SWPBIS. This variation and deviation from original models presented a challenge to the fidelity of research on RtI and SWPBIS (Berkely et al., 2009; Keller-Margulis, 2012; Kittelman et al., 2018; Schiller et al., 2020).

It became clear that tiered models were a flexible tool or framework with potential to be used in various schools but a new term was necessary to capture the evolving systems of tier that were no longer representative of RtI and

SWPBIS in their original forms (Lane et al., 2012; McIntosh & Goodman, 2016; Shogren et al., 2016). In the world of education, this broader conception of tier as an organizational mechanism for prevention and interventions in schools has come to be known as Multi-tiered Systems of Support (MTSS), a category system meant to encapsulate the integration of academic and behavioral focused systems like RtI and SWPBIS, but also, to allow more flexibility in tiered systems in schools that might be focusing on a combination of, or on different domains than, RtI and SWPBIS (McIntosh & Goodman, 2016; Shogren et al., 2016).

While the term MTSS is generally used to refer to all the variations of tiered systems that evolved from the three-tier public health model rather than one specific tiered system, its use still widely varies. For example, while there have been suggestions that MTSS and RtI may be used interchangeably (National Center on Response to Intervention, 2015), some programs use MTSS to refer to social-emotionally focused tiered systems while others use a mix of terms like "MTSS/RTI" to refer to solely academically focused tiered tools (Schiller et al., 2020), and others use MTSS or "socioemotional MTSS" to refer to purely behaviorally focused tiered tools (see Steed & Shapland, 2020). The fidelity of implementation of MTSS reveals a similarly inconsistent story. In one review of 21 state-sponsored tiered tools referred to MTSS, only one school had produced information regarding validity and reliability of their MTSS system (Schiller et al., 2020). Given this inconsistency in practice, and confusion in definition, the term MTSS will not be used to refer to the tiered model in the current dissertation.

Instead, "tiered intervention tool(s)/tiered tools" and "tiered models", will be used throughout the current paper.

Limitations in Extant Tiered Systems. MTSS evolved in part, due to the expansion of original RtI and SWPBIS systems, but also because of notable weaknesses in these systems towards serving the needs of children in a holistic manner. For example, while behavior is an important and visible non-academic student need, the root cause of behavior (e.g., poverty, low self-esteem, violence at home or in one's neighborhood, mental health more broadly) is not addressed in SWPBIS (Algozzine et al., 2014; Kittelman et al., 2018). Tiered intervention tools that focused purely on in-school visible risk factors (e.g., maladaptive behavior) fell short of addressing the social-emotional domain as a whole, and even further short of addressing the whole child. Some researchers acknowledged this weakness early on, in both RtI and SWPBIS systems, and strove to integrate other, less visible, elements of social-emotional development into the three tiers (e.g., three-tiered intervention to improve self-determination and a three-tiered intervention to improve bullying, both still under the name SWPBIS (Bradshaw, 2013; Shogren et al., 2016)). While more recent tiered models include increased social-emotional foci to varying degrees, the tendency to focus on one or a few components of social-emotional development still falls short of capturing the whole child (Durlak et al., 2011; Lane et al., 2012; Shogren et al., 2016; Stephan et al., 2015).

In addition to being limited in terms of social-emotional and whole child focus, school-based tiered intervention tools are also limited in terms of context of

focus (e.g., connecting students to services in non-school settings like the family or community settings). While some interventions report including families in some way (e.g., updating parents on their child's progress), this level of coordination with out-of-school contexts of development is not common. Integrating the engagement of the child in their community is even less commonly documented. (Olweus et al., 2007; Ross & Horner, 2009). This is misaligned with recommendations from developmental theory that suggest that a child's development not only occurs across developmental domains, but also, across a child's multiple contexts with development in one context impacting development across all contexts (Bronfenbrenner & Morris, 1998; Bronfenbrenner & Morris, 2006; Ford & Lerner, 1992; Lerner, 1995; Rutter, 2007; Sameroff, 2009).

The developmental literature would suggest that any intervention that does not comprehensively assess multiple developmental domains and coordinate services across a child's various contexts will be limited in its efficacy and its effectiveness. The following section reviews the ways in which the efficacy of tiered intervention tools is measured as well as the gaps in understanding their efficacy.

Extant Literature on Risk as an Outcome. The extant literature on tiered intervention tools typically use academic and behavioral outcomes to demonstrate the efficacy of the prevention and intervention strategies. For example, higher grades, and decreased number of behavioral incidences, might indicate the benefits of a tiered tool in contrast to a decrease in the student tier/risk level serving as the indicator.

However, the non-tier poverty-related risk literature has some examples of outcomes more closely associated to risk level itself. Much of this literature uses cumulative risk indices (i.e. number of poverty-related risk factors) as the measurement of risk rather than tier. Thus far, only one study has looked at risk as a predictor and outcome (Gassman-Pines & Yoshikawa, 2006), whereas other studies use risk as a predictor, mediator, and in very few cases a moderator (Evans & Kim, 2007; Evans & Cassells, 2014; Mackenzie et al., 2014).

In the single study by Gassman-Pines and Yoshikawa (2006) that looks at risk as a predictor and outcome for people living in poverty, it was found that targeted anti-poverty programs could in fact decrease the level of initial Cumulative Risk. Given this was the only study of its kind and that it was done at the community, rather than school level, it is hard to know whether findings suggest that risk levels can be decreased by school-based interventions that don't specifically target poverty in the traditional way (i.e. financial interventions). Further, the Gassman-Pines and Yoshikawa (2006) study uses broad indicators of poverty-related risk, leaving it uncertain whether school-level risks (e.g., social-emotional risk level) might also be impacted in a similar way.

When considering the applicability of these results for tiered intervention tools, it might be possible that cumulative risk level decreases after participation in targeted interventions (e.g., tier of risk decreases). Alternatively, it is possible that risk level stays the same while risk-associated outcomes shift (e.g., improved grades). Further studies are necessary to draw any conclusions about whether holistic risk levels are impacted by targeted interventions.

Cumulative Risk Versus Unique Risk Profile. While prior studies have taken a cumulative risk approach in quantifying risk level and preventive intervention outcomes, they do not usually investigate the unique risks of individuals (e.g., having no close friends/social supports). Instead, they focus on community-level and poverty-status indicators (e.g., parental employment status). There is some research that suggests that assessing individual risk may be just as important as calculating global/environmental risk scores. This consideration of individual risk factors is especially important for children whose experience of unique risk factors can lead to significantly different outcomes than their peers who may be exposed to the same broader poverty, and whose exposure to risk earlier in life poses even more pernicious effects than people who are exposed to poverty in adulthood (Atkinson et al., 2015; Appleyard et al., 2015; Horan & Widom, 2015; Rouse et al., 2019).

For example, one study that focused on a low-income, urban, sample found that a child's unique profile of risks more accurately predicts negative outcomes than their poverty status (Gassman-Pines & Yoshikawa, 2006). This study's findings suggest that for interventions to impact poverty-related outcomes, a comprehensive risk assessment that identifies risks in an individualized way (rather than just assessing a Cumulative Risk score, for example), is critical so that those risks can be specifically targeted in intervention efforts. Importantly for the current study, tiered intervention tools that assess general category of risk as well as individual risk factors, may be most effective.

Current state of tiered intervention tools. In sum, tiered intervention tools, despite their being derived from longstanding public health models, are fairly new in their use in educational settings and are often misaligned with recommendations of developmental theory and whole child approaches. Specifically, there are a limited number of consistently implemented and researched tiered intervention models that are comprehensive in the developmental domains they address, and that refer to services coordinated across a child's multiple contexts. Even with these limitations, government officials and educational researchers alike, note the potential of tiered intervention models, particularly for low-income communities where there is higher and more intense risk as well as larger variability of risk (Freeman et al., 2017; Ross & Horner, 2009; Gamm et al., 2012; Ross & Horner, 2009; Stoiber & Gettinger, 2015).

One major potential strength of tiered intervention tools is their flexibility to help organize services to prevent and intervene upon a wide variety of developmental domains and levels of risk. Further, the close monitoring of students by tiered intervention models allows for closely attuned intervention and prevention services that respond to students' ever-shifting needs (Freeman et al., 2017; Ross & Horner, 2009; Gamm et al., 2012; Ross & Horner, 2009; Stoiber & Gettinger, 2015).

In short, while the potential for tiered intervention models is promising, research and development is critically indicated to further align tiered models with developmental theory, to improve reliability and validity measurements of tier, and to understand whether tier of risk in and of itself is a valuable outcome

measurement (National Prevention Council, 2011; O'Connell et al., 2009; Moore et al., 2017; Schufelt & Cocozza, 2006; U.S. Department of Health & Human Services, 2010; Walsh & Brabeck, 2006). As the field of education shifts to better serve populations most impacted by the opportunity gap, utilizing tiered intervention tools that are closely aligned with developmental theory will allow for more holistic and long-lasting changes in and out of the classroom.

Integrated Student Support

One way in which tiered intervention tools have grown in complexity and ability to meet the needs of the whole child is through their use as part of larger, more comprehensive interventions. These comprehensive interventions aim to meet the in- and out- of-school needs of the whole child in a systemic way. One example of these comprehensive interventions is a subset of school-based interventions known as Integrated Student Support (ISS) interventions. ISS refers to school-based interventions that meet academic and non-academic needs of students, are evidence-backed, comprehensive, and coordinated in nature. ISS interventions address student needs in and out of school through use of targeted and coordinated services and programs (Moore & Emig, 2014; Moore et al., 2017).

The increase in identification and promotion of effective, holistic, and individualizable interventions through ISS has been particularly important for students living in underserved urban areas where levels of need differ drastically not only by individual student, but also across schools, families and/or communities. Urban areas also seem to underutilize community-based resources

and/or evidence a gap in communication between community and school providers (Capella et al., 2008; Kim et al., 2018; Ortega et al., 2018; Walsh et al., 2002; Walsh et al., 2014). Thus, ISS programs include systems for schools to communicate with community providers and families in order to individualize and coordinate services for students across contexts (Moore & Emig, 2014).

Child Trends, a non-profit educational research organization, identified and assessed 21 ISS interventions currently implemented throughout the United States (Moore et al., 2017). These 21 interventions were comprised of eight unique ISS models. Amongst these ISS models, analyses showed that four were the most robust in terms of having the strongest, research-driven and validated implementation/methods, and importantly, the greatest positive academic outcomes. These four identified successful ISS models were: Communities in Schools, Diplomas Now, Harlem Children's Zone's Promise Academy, and City Connects, the intervention of focus in the current dissertation (Moore et al., 2017).

Tier within ISS

The ISS literature identifies and endorses tiered intervention tools as one of the preferred tools to be used within ISS interventions (Moore & Emig, 2014). While tiered intervention tools are commonly used as part of many ISS interventions, there are many different tiered intervention tools used leading to inconsistency across ISS models. Further, while ISS as a whole is aimed at addressing the needs of the whole child, within ISS, tiered models are used to address only one or a few domains of the whole child (e.g., behavior and/or academics), while addressing the other domains through other, non-tiered,

methods. This ISS approach to implementing tiered intervention models mirrors the approach used thus far in the school-based tiered models and therefore, also embodies the weaknesses in current tiered models. Further, the inconsistency in tiered intervention models utilized across ISS interventions makes refining and validating tiered tools a significant challenge.

City Connects

One ISS interventions, City Connects, uses a unique tiered intervention tool that accounts for and counters many of the weaknesses in the use of tiered intervention tools in schools thus far. The City Connects tiered intervention tool is used in a comprehensive way to assess strengths and risks in all developmental domains. Prior to delving into the City Connects tiered tool, the development and the implementation of City Connects will be described.

History and Overview of City Connects Model

City Connects was initially started as a partnership between Boston College and Boston Public Schools to better meet the needs of children in traditionally under-resourced schools. This marriage of research and practice developed out of the consensus between researchers and schools that the out-of-school needs of students were not being met sufficiently. These unmet needs were leading to low academic achievement as well as burnout of school staff who were attempting to meet the non-academic needs of children without the necessary training or resources, common problems in urban low-income schools. In response, psychologists and educators joined their areas of expertise in the fields of developmental science and educational practice to develop an intervention that

assessed and met the academic and non-academic needs of each and every child by capitalizing upon and coordinating extant school and community resources and consistently monitoring each child's progress thereafter (City Connects, 2010; Walsh et al., 2014).

Since this initial development, City Connects has expanded significantly due to its documented success, and is currently being implemented in over 90 schools across five states. City Connects is primarily implemented in urban centers in historically underserved elementary schools that are attended by a majority of children from marginalized backgrounds (i.e., poverty, Students of Color, English language learners) and are most affected by the opportunity gap (City Connects, 2018; Walsh & Backe, 2013).

The City Connects practice is implemented by a City Connects Coordinator, who is referred to as a School Site Coordinator (SSC). This SSC is a masters-level school counselor or social worker who works for the City Connects intervention but is placed within the school as a full-time staff member. The SSC inputs data on students into the City Connects proprietary data system, SSIS. SSCs receive training and consistent professional development through Boston College-based staff who work to monitor intervention implementation and fidelity and to collect and analyze data from all City Connects schools.

The tiered intervention tool critical to the City Connects process and unique to the City Connects intervention is implemented during a process entitled "Whole Class Review" (WCR) which occurs during the fall of every school year. During WCR, SSCs meet with each classroom teacher and discuss each and every

student's strengths and needs across academic, family, health, and social-emotional domains. The final step of this initial WCR meeting is to collaboratively assign each student a tier rating based on the holistic consideration of the identified strengths and needs in academic, family, health, and social-emotional domains. This tier rating assignment is relative to the classroom population rather than a standardized population risk level (i.e., a student who receives a Tier 2a rating assignment in one classroom may be assigned a Tier 1 rating in another classroom where average risk levels are higher). Based on tier rating assignment and the associated strengths and needs profile of each student, prevention and intervention services are individualized and coordinated across home, school, and community contexts (City Connect 2012; Walsh et al., 2002; Walsh et al., 2014).

City Connects Results

WCR and its associated tiered intervention tool are fundamental elements of the City Connects intervention and implementation that bring together the whole-child, comprehensive, and coordinated approaches integral to ISS, and assure that each child is being assessed, served, and monitored by the intervention. Only after the WCR and tiering has been conducted can the intervention continue to be implemented through coordinated and comprehensive service delivery for each child.

The primary way in which the City Connects WCR, tier rating assignment, and their associated services have been assessed has been by studying student outcomes in the short and long term, a method consistent with the outcomes-

literature on tiered intervention tools in schools. Indeed, students in schools that implement the City Connects intervention have shown improved academic outcomes as assessed by better report card grades and standardized test scores and these results are maintained beyond the time a student leaves a City Connects elementary school. The longer a student stays in a City Connects school, the larger the positive impact on academic performance (City Connects, 2012, 2018, 2020; Walsh et al., 2014). Further, City Connects has positive behavioral benefits in that students are more likely to show better academic effort, less likely to drop out and less likely to exhibit chronic absenteeism, results that are also maintained into high school, for students who attended City Connects schools for elementary school. Strikingly, City Connects has been shown to be especially effective in promoting positive academic and behavioral outcomes for marginalized populations that are most at risk for academic failure like first generation immigrants, English Language Learners (ELL), and male students of Color (City Connects, 2010, 2018; Dearing et al., 2016). These results are consistent across City Connects implementation sites.

These findings suggest that even for students most at risk for school drop-out, City Connects is effective in improving academic performance and behavioral outcomes, and that these results are long lasting. However, studies on City Connects have yet to identify any changes on tier level/rating itself. This gap in the City Connects literature on tier-associated outcomes reflects a gap in the larger school-based intervention literature on tiered- associated outcomes.

City Connects Tier

Originally, City Connects used a three-tier model that closely aligned with the three-tiered public health model in its structure (i.e., three tiers with each increasing tier signifying an increase in risk level). After its initial development, City Connects tier structure changed in response to requests from school staff who were implementing the City Connects intervention. The change in structure was marked by a shift from a three-tier model to a four-tier model that was intended to further divide Tier 2, a category which practitioners felt was too broad in terms of its associated strength/risk levels to be represented by a single level. The current version of the City Connects tier model includes: Tier 1 (strengths and minimal risks), Tier 2(a) (strengths and mild risks), Tier 2(b) (strengths and moderate risks), and Tier 3 (strengths and severe/intensive risks) (City Connects 2012; City Connects 2014; Walsh et al., 2014).

Similar to assignment of student strength/risk status to a tier level/rating, tiers are also used to classify prevention and intervention services to which the City Connects intervention refers students. Services are classified into three tier categories true to the original public health tier model (prevention and enrichment (Tier 1), early intervention (Tier 2), and intensive/crisis intervention (Tier 3), services). While a student may receive the designation of Tier 3 (strengths and severe risks), he/she won't necessarily receive only Tier 3 services. For example, a student who has significant social-emotional risk factors due to early experiences of trauma and therefore whose strength and risk profile may best align with Tier 3, may also receive some Tier 1 services (e.g., a vision screening which would be classified as a preventive service (Tier 1) in the health domain).

All students, regardless of the intensity of risks they experience, receive enrichment services which are classified as Tier 1 services, to capitalize upon their strengths.

This model of independently assigning a tier rating to both the student's strengths and risks and the risk/intensity level of services is one of the ways the City Connects model of tiering is unique and allows for flexibility towards meeting each child's individual strengths and needs in a tailored and holistic manner. Further, given that a WCR is conducted and a tier is assigned each and every year that students remain in a City Connects school, there is constant reevaluation of student strengths and needs so that corresponding services are responsive to ever-evolving strengths and needs.

Previous research on City Connects Tier. Extant research on the City Connects tier rating assignment process is cross-sectional. These cross-sectional studies of tier show that the mean number of services that a student receives increases as level of risk/tier increases. In other words, students who are assigned a Tier 1 rating assignment based on their strength/risk profile receive the least number and students who are assigned a Tier 3 rating assignment receive the highest number of services out of all tier groups. This increase of services for students categorized as higher at risk is expected given that students assigned a Tier 3 rating require both prevention and intensive intervention services to counter the high level of risk they experience. These findings are consistent across City Connects schools and over the time that City Connects has been implemented (City Connects 2010, 2012, 2014, 2018, 2020). Meanwhile the

number of prevention and enrichment services stay relatively consistent across tier rating assignments, consistent with the notion that every student has strengths regardless of experienced risk (City Connects, 2010, 2012, 2014, 2018).

Additionally, as tier/ level of risk increases, so does the likelihood that a student has experienced at least one in-grade retention, a finding that suggests that students who receive a higher tier rating assignment perform worse, academically, than their lower tiers of risk peers (City Connects, 2010). This finding is consistent with developmental science notions of risk as placing students at higher risk for academic failure and associated life consequences.

In sum, cross-sectional studies validate that students assigned a Tier 3 rating experience the greatest number of risks, thereby requiring the highest number of services to buffer against these risk factors. While these cross-sectional studies of tier rating are not directly geared towards validity and reliability, their findings are consistent with measurements of convergent criterion validity. In other words, they show that tier rating assignment is measuring what it is intended to measure - the proportion of strengths to risk, and the level of intensity of risks.

Preliminary Longitudinal Studies on City Connects Tier. While no published study has examined tier rating as an outcome, in a series of posters accepted and presented at the American Psychological Association's national conference over the course of two consecutive years, this author (Petsagourakis, 2018; 2019) examined tier change over the course of one year for students in City Connects schools in one district in the northeastern United States.

In the first of these preliminary studies, results showed that while 50% of students received the same tier rating assignment over the course of one year, 31% exhibited a decrease in tier/risk level, and 18% exhibited an increased their tier/risk level. Then, in a follow up study, it was found that students who exhibit strengths and risks consistent with a Tier 3 rating assignment, are significantly more likely to transition to lower tiers/risk levels than students who received a Tier 1 rating assignment were to move to higher levels of tier/risk. In other words, students with few risks and many strengths were less likely to exhibit increasing levels of risk than their peers with more significant risks were to experience a decrease in risk.

This finding aligns with the knowledge that City Connects not only identifies and critically intervenes upon risk but also works to prevent students who receive at Tier 1 rating assignment from developing risk factors. Still, these studies are exploratory and preliminary in nature. Thus, while the findings do seem to indicate that the City Connects intervention is having differential impacts on students who have different levels of risk such that students at higher risk may decrease risk over time, while students at lower risk may maintain this lower-risk status, further studies are necessary to draw any definitive conclusions about changes in tier rating assignments over time.

Next Steps in Studying City Connects Tier. While previous studies on cumulative risk illuminate potential relationships between interventions, and decreased cumulative risk levels, these studies do not look at risk levels that have been assessed in as individualized, and developmentally sound way as that of the

City Connects intervention tiered tool. City Connects assesses risk in each and every child and does so in academic, social-emotional, health, and family domains. Further, City Connects includes a measure of strengths in its assignment of tier. This strength *and* risk consideration in the City Connects tier model makes it distinct from previous models of tier and previous models of measuring Cumulative Risk. Therefore, it is difficult to generalize any conclusions from prior risk outcome studies to the ways in which City Connects may affect student tier outcomes. However, the developmental science literature would suggest that by treating risks and capitalizing on strengths, an even more effective system of minimizing risks and optimizing outcomes could emerge.

The scientifically-grounded nature of the City Connects intervention, the previous literature on the impacts of interventions that aim to treat risk, and the documented positive impacts of the City Connects intervention, suggest that City Connects might not only be affecting student outcomes, but could also be decreasing student tier/risk levels for students at highest risk for negative outcomes. The current study seeks to better understand if and how this impact on tier rating occurs.

Literature Summary

Poverty's deleterious impact on child development cannot be understated. Due to inequitable systems and access to resources (i.e., the "opportunity gap") children living in poverty have demonstrated lower levels of academic achievement than their wealthier peers as well as a host of other maladaptive life outcomes including, but not limited to, higher rates of incarceration, higher

incidences of mental health challenges, and higher mortality rates. Developmental science provides a framework for understanding these issues as interconnected and cumulative, disallowing for the assumption that addressing challenges in one domain in isolation will be effective. As such, schools have been a targeted context to prevent and intervene upon poverty-related risk factors.

Early-developed school-based interventions focused mostly on interventions for academics and for several years did not address other non-academic domains. Then, as developmental science began to reveal the impact of out of school challenges on in-school academic performance, interventions increasingly addressed non-academic as well as academic needs, and focused on prevention as well as intervention. Tiered intervention tools derived from early public health tiered models were a common mechanism for categorizing and delivering these intervention and prevention programs given their ability to distinguish between varying levels of risk of people and intensity of services.

As school-based interventions evolved to address non-academic as well as academic domains, tiered intervention tools also evolved to meet more of the needs of the "whole child". A subset of school-based intervention and prevention programs that use tiered intervention tools are known as Integrated Student Support. ISS models take a whole child approach, align with core principles of developmental science, use research and data to monitor progress, and also support student needs in a coordinated way across contexts (i.e., school, home, and community contexts). There have been national efforts to promote and research these ISS programs given their great promise for meeting the needs of

students most impacted by the opportunity gap. Still, most ISS models only use tiered intervention tools as a small part of their larger intervention models. Therefore, they maintain many of the current weaknesses in tiered intervention tools. To be specific, these models of tiered interventions focus on only a few developmental domains rather than the whole child. Therefore, their associated services are school-focused and don't include services that are coordinated between in and out of school contexts.

One ISS model, City Connects, uses a holistic and comprehensive tiered intervention tool as a core feature of its intervention implementation. City Connects has proven to be a very successful ISS model, showing long-lasting impacts on academic and behavioral outcomes for students who live in poverty. While a significant portion of the City Connects literature, as well as the larger tiered intervention literature, has been dedicated to describing and validating tier rating assignment processes and foci, little is known about City Connects tier beyond its use for initial assessment of strengths/risk and its correlation with other intervention mechanisms such as services. It is suspected, but still unknown, that students in City Connects schools are more likely to exhibit a decrease in tier rating assignment (i.e. risk level) over time in the intervention than they are to exhibit an increase in tier/risk. This is further supported by a limited body of literature on anti-poverty programs that demonstrate that risk can in fact be reduced through intervention (Gassman-Pines & Yoshikawa, 2006). It is possible that by examining whether and how holistic strength and risk levels change, an insight could be gained into additional uses for research on tier rating assignment

towards understanding the impact of intervention on social-emotional strengths/risk over time or for further elucidating patterns of strength and risks over time within the context of an ISS intervention.

The current study explores City Connects tier over the course of elementary school. Given the increasing use of tiered intervention tools towards addressing social-emotional needs, the current study also seeks to understand how social-emotional factors may impact tier rating assignment. Importantly, the current study investigates social-emotional factors while also accounting for strengths and risks in academic, family, and health domains. While more nuanced and complicated to interpret, this approach allows for a developmentally sound illustration of the interplay of strengths and risks across domains and over time in the context of a whole child ISS intervention. Therefore, the current study not only has the potential to add to the extant school intervention literature, but also to prevention and developmental science more broadly.

Study aims and research questions

This dissertation has three aims which are described below along with their associated research questions and hypotheses. It should be noted that while hypotheses are proposed for each of the three research questions, this dissertation has an overarching exploratory scope given that no prior research has explored within-child tier rating assignments longitudinally.

Note on terminology

The following research questions and analyses seek to quantify longitudinal patterns associated with tier rating and therefore various terms are

used towards this quantitative purpose. *Tier rating/level* assignment refers to the four possible City Connects tier levels (Tier 1, 2a, 2b, and 3) that can be assigned to students. While all tier levels/ratings encompass an assessment of strengths and risks, a change to a higher tier number (highest tier is Tier 3) corresponds with a higher level of risk. This is due to an increase in the number or intensity of risks leading the ratio of strengths and risks to be risk-heavy. Therefore, sometimes *tier of risk* or *tier/risk level* will be used for ease of interpretation. In order to describe change in tier rating, the terms *increase/decrease in tier* will be used where *increases in tier* suggest an observed increase in risk level (e.g., a change from a rating of Tier 1 during year 1 of the study to a rating of Tier 3 during year 2 of the study), while *decreases in tier*, suggest a decrease in risk level (e.g., a change from Tier 3 rating during year one of the study to Tier 2a in the second year of the study). These *increases* or *decreases* also signify the *direction of tier change* to a lower or to a higher tier of risk. Finally, in order to quantify the number of tiers that might change between any given time points, the term *intensity* of tier change will be used. For example, a tier rating increase from Tier 1 to Tier 3 has an intensity of three (three tier level difference between 1 and 3) and a tier rating increase from Tier 1 to 2b which has an intensity of one. Finally, any distinct patterns of tier rating assignments and tier change over time will be referred to as *Tier Change Profiles.*

Study Aim One

The first aim of the current study was to determine whether variability exists in tier ratings and tier change over five years, from kindergarten or first

grade, through fourth or fifth grade, respectively. In other words, do students exhibit changes in tier ratings and if so, what does this change look like? Further, this study sought to understand on average, the frequency, direction, and intensity (i.e. number of levels) of tier change between each of the five years/time points included in the current study.

Research Question 1: *Do the annual tier ratings/risk levels (Tier 1, 2a, 2b, and 3) of individual students change between first and fifth grade time points? What is the average number of times a student changes tier out of four possible changes between each of the five, time points? On average, what is the number of tier levels (-3,-2,-1,0,+1,+2, or +3) that change between time points and in what direction is the change (increasing or decreasing tier/risk level) ?*

Hypothesis 1: Pilot studies show that City Connects' within student holistic tier ratings sometimes shift over the course of one year and when shifts occur, they are more likely to be in the direction of lower tiers of risk. However, this is the first- longitudinal study of within-student tier rating change over the course of five years in elementary school. Therefore, this research question was designed to be largely descriptive and exploratory in nature. Given significant variability in normative development that occurs within this age group, it could not be predicted that tier rating assignment would remain constant over time. It was hypothesized that variability in development as well as responsiveness to intervention might be reflected in the data such that there would be within student variability in tier rating over time, and between student variability in number of

total tier changes as well as intensity and direction of change (e.g., increasing or decreasing risk by 1, 2, or 3, tier levels).

Study Aim Two

The second aim of the current study, was to identify any patterns in tier ratings or tier change such that discrete groups of students with similar patterns of tier ratings at each time point, and change between time points, could be distinguished from other groups of students with different patterns (Tier Change Profiles).

Research Question 2: *Are there characterizable patterns of holistic tier ratings (Tier Change Profiles) over the course of the five sequential, elementary school years included in the current sample such that there are discrete subgroups of students who have similar tier ratings at the same time points and similar direction of tier change (increase or decrease in tier) as well as intensity (number of levels of tier change) of tier change between timepoints?*

Hypothesis 2: It was hypothesized that there would be identifiable groups of students that experience similar patterns of tier change (i.e., Tier Change Profiles). Specifically, it was expected that there would be students who receive a low tier/risk rating (Tier 1) at baseline and remain at low tier rating assignments due to their experience of minimal risk, the intervention's preventive focus, and the bolstering of strengths through provision of enrichment services in home, school and community settings. In parallel, it was hypothesized that it would be likely that there would be an identifiable group of students who receive a high tier/risk rating (Tier 3) at baseline would remaining at a high tier/risk rating due to

their experience of significant risk factors, some of which may be challenging to fully address through a school-based intervention (e.g., poverty, homelessness, etc.). For students who receive a Tier 2a or 2b rating assignment at baseline (mild to moderate risks), it was hypothesized that it would be likely that there would be significant variability in their trajectories due to a combination of developmental change and/or changes stimulated by the intervention and/or changes in the broader context, all of which result in different combinations of risk and protective factors. It is also important to note that statistical floor and ceiling effects restrict variability among Tier levels 1 and 3 but not among Tiers 2a and 2b. Given City Connects' record of positive impacts and its grounding in developmental science, it was hypothesized that students who receive Tier 2a and 2b tier ratings would have patterns of tier ratings that suggest a decrease in identified risks over time.

Study Aim Three

The third and final aim of the current study was to further understand the relationship between social-emotional strengths, needs, and services and tier pattern over time. City Connects takes a more holistic approach to considering social-emotional strengths and needs than many other school-based interventions, and does so while also simultaneously assessing and addressing strengths and needs in academic, family, and health domains. The current study made hypotheses about social-emotional strengths, needs, and services while accounting for, but not hypothesizing about academic, family and health-based needs, strengths and services.

Research Question 3: *Do students' number of identified social-emotional strengths and needs and number of social-emotionally focused services significantly impact their Tier Change Profiles (i.e., characterized pattern of tier ratings and tier change) over the course of five years?*

Hypothesis 3: While most tiered intervention tools and school-based interventions focus solely on student risks, City Connects assesses strengths as well as risks in order to refer students to services that capitalize on these strengths in light of the knowledge that strengths-based approaches can help to buffer against risk. Given that developmental science has demonstrated the positive impact of strengths on development, it was hypothesized that the higher the number of social-emotional strengths a student experiences, the more likely that the student's pattern of tier rating assignments over time would remain stable or decrease. It was also hypothesized that having a larger number of social-emotional needs, while likely predictive of a higher tier/risk level, would also be predictive of stable or decreasing tier ratings over time. Similarly, it was predicted that a high number of services in the social-emotional domain would be associated with stable or decreasing tier/risk level. While social-emotional needs are the focal point of research aim three, academic, family, and health domains were included in analyses to maintain the exploratory and whole child lenses of the current study.

It should be noted that, these hypotheses are focused on patterns of change over time as opposed to tier ratings at any given timepoint (i.e., remaining stable or decreasing in tier rating assignment regardless of initial tier rating). More

concretely, while these hypotheses do suggest a similar Tier Change Profile for students with a large number of social-emotional strengths as they do for students with a large number of social-emotional needs, they do not predict that students with high numbers of social-emotional strengths would be given the same tier rating assignments as students with a high number of social-emotional needs or a high number of services.

Chapter 3: Method

The current study examines the five-year tier trajectories (tier change over time) of students assigned to one of four whole child tiers-of-risk in one district implementing the City Connects intervention. The method is described in the current chapter.

Research design

In order to investigate the composition of tier rating assignments at time points one through five, descriptive analyses of tier and other background variables were conducted at each time point using SPSS statistical software.

To test hypothesis two regarding characterizable groups of students with similar tier rating assignments at each time point as well as similar transitions between time points (Tier Change Profiles), a repeated measures latent class analysis (RMLCA) was conducted using MPlus software (version 8.4) where latent classes represented distinct Tier Change Profiles. Latent transition analysis (LTA) and RMLCA are the two most common longitudinal modeling techniques in the social and developmental sciences for characterizing groups using categorical indicators (Collins & Lanza, 2010; McCutcheon, 1987). RMLCA was selected rather than LTA due to this dissertation's focus on the overall "picture" of tier rating assignments over time rather than an interest in any specific transition between two time points or in statistically verifying the groups of tier ratings at each time point.

RMLCA is a person-centered extension of LCA that uses categorical indicators measured over multiple time points to determine whether discrete

patterns of ratings, behavior, or responses, exist. While cross sectional LCA uses multiple indicators measured at one time, RMLCA uses one or more indicators measured at multiple time points. Both tier ratings and tier change (difference between the tier ratings at two subsequent time points) were included as indicators (Collins & Lanza, 2010; Hickendorff et al., 2017; McCutcheon, 1987).

Chi-square and multinomial logistic regression were run in SPSS to test hypothesis three regarding whether social-emotional factors are associated with, and impact a student's likelihood of exhibiting a particular Tier Change Profile. Chi-square and multinomial regression analyses have commonly been used in the literature to test the relationship between covariates and latent class membership (Clark & Muthen, 2009; Hogan et al., 1993; James et al., 2016). Given the exploratory scope of the current study, additional background covariates were included in the multinomial regression model to assess the impact of various sample characteristics on class membership. The analytic plan is described in further detail in the final section of the current chapter.

Sample

The longitudinal sample was comprised of data from a large urban public school district located in the Northeast region of the United States. This district began implementing City Connects in the 2011/12 school year. The district was chosen because it has implemented City Connects for at least five years, the scope of the current study, and has undergone rigorous evaluation to assure it is implementing City Connects with high fidelity. Most recently, a study on academic impacts of the City Connects intervention in the district of focus

showed that, students in third, fourth, and fifth grade in City Connects schools demonstrated significant improvement in math and English language arts (ELA) after the onset of City Connects implementation in 2011. These results were not found for the control group who were students in non-City Connects schools in the same district that had similar demographic profiles and attended schools with similar characteristics to those implementing City Connects (Khanani et al., 2021). Overall, students in this district have demonstrated positive academic and behavioral outcomes that are consistent with the City Connects intervention nationally (City Connects, 2018; Dearing et al., 2016; Walsh et al., 2014).

This study's data was collected by City Connects staff through the City Connects web-based secure, proprietary data management system, the Student Support Information System (SSIS). Through SSIS, City Connects coordinators report student and school level data to City Connects administration and research staff. Schools also provide City Connects with demographic information about their students. The current dissertation used a subset of combined data from SSIS and school-provided data. The dataset was constructed for and provided to the author by City Connects staff. All student-level data was de-identified.

Participants

Inclusion criteria. Initial inclusion criteria required students to be in first grade in 2012-13, 2013-14, or 2014-15 school year in order to keep developmental factors constant. However, given limited sample size, inclusion criteria were expanded such that students could be in kindergarten or first grade at time one rather. Allowing students to be in kindergarten or first grade at time one

decreased the amount of missing data for students while maintaining the developmental time frame of the study. Table 1 shows the corresponding timepoints (one through five) for each of the three cohorts (2012, -13. Or -14) demonstrating that regardless of cohort, that year was labeled “time one”/baseline for the current study making it so all students were in kindergarten or first grade at baseline.

Table 1

School years and their corresponding timepoints for each cohort

	Schoolyear						
Year attended K or 1st grade	2012/13	2013/14	2014/15	2016/17	2017/18	2018/19	2019/20
2012/13	Time 1	Time 2	Time 3	Time 4	Time 5	-	-
2013/14	-	Time 1	Time 2	Time 3	Time 4	Time 5	-
2014/15	-	-	Time 1	Time 2	Time 3	Time 4	Time 5

Additional inclusion criteria were, students were required to attend a City Connects school within the district for at least three years, and have at least three out of the five years of tier data to be non-missing. The 2018-19 school year data (year five for the 2014-15 cohort) was limited due to delays in data transfer from the district to City Connects. Missing data from the 2018-19 school year were strengths and needs and special education data (special education status, type of disability, intensity of need, time of service needed). However, variables of central interest (tier rating assignment, demographic information, number of services provided by domain and intensity) were available.

The final sample included 1018 students out of 6247 students who were in first grade in the chosen district's City Connects school in 2012, -13, or -14. This subsample of 1018 students attended a City Connects school for more than three years and had non-missing tier data for at least three years of their attendance making them eligible for the current sample. Handling of missing data for the included sample will be further discussed in the discussion section.

When compared with students who did not meet inclusion criteria, the students in the current sample were more likely to qualify for free or reduced lunch, less likely to be White or Asian, and more likely to be Latinx, more likely to qualify for Special Education, and more likely to qualify as having Limited English Proficiency (as determined by chi square p values of less than .01). Included and excluded students did not differ on gender ($p>0.05$). It should be noted that City Connects was only implemented in the "turnaround" schools in the current district. "Turnaround" is a phrase coined by the federal government to characterize schools that have shown failing academic achievement scores. They are labeled as "turnaround "to symbolize that there are programs and funding in place aimed to improve academic achievement.

Background characteristics. Demographic (e.g., gender) and education-related (e.g., special education status) data was gathered from school district records. School districts receive this data from parents at the time that they enroll their students in the public-school district and update this information as is relevant (e.g., if a child qualifies for special education services).

Out of the 1018 students included in the current sample, 54.6% were in kindergarten and 45.4% were in first grade (see Table 2). At baseline, 60.8% of students had never attended a City Connect school (zero years of City Connects), 26.1% had attended a City Connects school for one year, 11.5% for two years, and 1.6% had attended a City Connects school for three years. The number of years that a student had attended a City Connect school at baseline was referred to as "dosage". Students attended one of eight schools implementing City Connects in the district of focus (see Table 2 for number of schools, and percent of students per grade, at each of the five time points).

Table 2

Cohort, grade, and mobility data for each time point

	Time 1	Time 2	Time 3	Time 4	Time 5
N of Students	N= 1018	N= 993	N= 938	N= 828	N= 605
N of Schools	N=8	N=9	N=12	N=18	N=18
Cohort					
2012-13 K	23.1%	23.7%	23.2%	23.9%	30.4%
2012-13 1st	23.6%	23.8%	24.4%	25.2%	22.5%
2013-14 K	31.5%	32.2%	30.7%	31.5%	30.4%
2013-14 1st	14.7%	13.8%	14.7%	13.9%	10.2%
2014-15 1st	7.2%	6.5%	6.9%	5.4%	6.4%
Grade					
K	54.6%	0.6%	-	-	-
1st	45.4%	60.4%	4.2%	-	-
2nd	-	39.0%	56.4%	7.6%	-
3rd	-	-	39.4%	55.2%	12.9%
4th	-	-	-	37.2%	55.7%
5th	-	-	-	-	31.4%
Repeat grade	-	4.9%	3.5%	2.5%	1%
Changed schools	-	3.6%	7.1%	6.4%	7.4%

In terms of demographic characteristics, 48.3% of students were female and 51.7% were male. Parents identified the race/ethnicity of their children on district forms when enrolling their children (see Table 3 for demographic

information). 6.3% identified as White, 17.6% as Black/African American, 73.2% as Hispanic/Latinx, 1.5% as Asian, 0.1% as Native Hawaiian or Pacific Islander and 1.4% as Native American. 66.9% of the sample's first language was English, 28.8% first language was Spanish, 1.5% spoke Somali, .7% spoke Vietnamese, .3% spoke Nepali, .2% spoke Kirundi, .2% spoke Aboriginal languages, and 1.5% identified "other" as their first language. During the five included years, 26.5% of students qualified as English Language Learners at one or more time points. 92.1% of the sample received free or reduced lunch based on state-designated poverty status. 26.2% of the sample were immigrants. Demographic data at each time point are described in Table 3.

It should be noted that while the sample appears to increase in proportion of students who qualify for free/reduced lunch, the district of focus' free/reduced lunch qualification criteria became less stringent over the course of the study and therefore these higher proportion more so reflect this change in policies rather than a change in the characteristics of the sample.

Table 3

Demographic information for students at each time point

	Time 1 N= 1018	Time 2 N= 993	Time 3 N= 938	Time 4 N= 828	Time 5 N= 605
Gender					
Male	51.7%	52.2%	51.4%	50.1%	51.7%
Female	48.3%	47.8%	48.6%	49.9%	48.3%
Race					
White	6.3%	6.4%	6.6%	6.4%	8.1%
Black	17.6%	17.7%	17.1%	16.9%	18.2%
Hispanic	73.1%	73.0%	73.3%	73.4%	70.2%
Asian	1.5%	1.5%	1.6%	1.6%	1.8%
Pacific Islander	0.1%	0.1%	0.1%	0.1%	0.2%
Native American	1.4%	1.4%	1.3%	1.6%	1.5%
Special Education	12.3%	13.9%	14.9%	15.8%	18.2%

Free/reduced lunch	63.9%	64.7%	83.6%	78.5%	78.6%
English learner	25.9%	25.3%	23.5%	17.8%	16.2%

Measures

SSIS Data – Tier

As stated in chapter two, City Connects uses its Whole Class Review (WCR) process to quantify risks and strengths across domains and to assign tier ratings. To review, WCR's tiering process is guided by previous versions of tier that were developed for public health and educational interventions, but is unique in that it is a holistic approach that addresses multiple developmental domains and multiple developmental contexts. In order to assign students to a holistic tier rating, a WCR is conducted at the start of each school year. During a WCR a City Connects coordinator, who is a school-based staff member, meets with every classroom teacher to assess each and every student's strengths and needs across family, health, social-emotional, and academic domains.

During the time of the WCR, the City Connect Coordinator also documents, via text-box data entry, each students' strengths and needs/risks in each of the four assessed domains. While Coordinators are instructed that a student's needs can be documented as "none" and still be considered a complete entry, a student's strengths must be filled out in order for the entry to be considered complete. Coordinators are required to fill out six out of the eight strengths and needs text boxes in order to file a complete assessment of student strengths and needs.

As a result of this assessment, students are assigned to one of four tiers ((Tier 1) strengths, minimal risks, (Tier 2a) strengths, mild risks, (Tier 2b) strengths, moderate risk, and (Tier 3) strengths and many risks) and then connected to a set of prevention, intervention, and enrichment services. Progress is then monitored and students undergo the same comprehensive WCR process in the fall of the following school year. Each year a student undergoes a new WCR and tier rating assignment that is not dependent on the prior year's tier rating.

Tier-related data. In addition to student tier rating assignment at each of the five time points starting in first grade or kindergarten, the data set also included several additional data points associated with tier rating and the WCR process. These data are described below.

Service data. Service data included the number of services by domain (number of (a) academic, (b) social-emotional, (c) family, and (health) services).

Strengths and needs data., At the time that WCRs are conducted, the Coordinators enter, via text entry, strengths and needs for each domain. These text entries include phrases separated by commas, spaces, or periods (e.g., health needs: "low weight, poor hygiene"). In order to quantify these entries for the purpose of the current analyses, Microsoft Excel was used to count the number of strengths or needs, separated by de-limiters, in each domain, for each child. A random selection of text entries was cross-checked with their corresponding count to assure count accuracy.

Reliability/validity of tier measurement. It is important to note that the City Connects tier rating assignment tool was developed with the intention of

being a tool for the City Connects practice that can help to organize and systematize intervention delivery and therefore, reliability and validity have not been of central concern.

While the City Connects tiered intervention tool's validity and reliability have not been formally tested, the City Connects evaluation team does a thorough assessment of student tier ratings as part of its annual fidelity and outcome studies. These assessments show some strong indicators both of reliability and validity. These studies show that each year in each district, approximately the same proportion of students is assigned to each tier, with the largest proportion in Tier 1 (minimal risk; around 30%-35%), and the smallest proportion in Tier 3 (highest risk; around 10-15%). This consistency of measurement is one indicator towards the reliability of tier and also demonstrates the relativity of tier such that each classroom has approximately the same proportion of students with each tier rating assignment. Further, out of all tiers, Tier 3 has the highest proportion of students receiving five or more services and the highest proportion of students receiving crisis services (City Connects, 2010; 2012; 2018; 2010). Alignment between service and tier variables is one indicator of criterion validity. In other words, tier rating and number of services, which would be expected to correlate, do in fact correlate.

While reliability and validity are not of primary concern in the current study, results of this study might offer new reliability and validity indicators of tier measurement through their identification of background, service, and strength

and needs variables that align with tier rating assignment and with tier change over time.

Analytic plan

Preliminary Analyses

Tier and service associations. To assure that tier is measured in alignment with previous studies, the percentage of students per tier rating/level at baseline were reported. Number of services by tier rating was also assessed and expected to align with previous findings such that students with a Tier 3 rating assignment receive the greatest number of services overall as well as the largest number of crisis services as compared with other tier groups.

Missing data. An analysis of attrition rates and missing data at each time point was conducted prior to beginning analyses. It is typical for longitudinal studies to report attrition rates between 30 and 70 percent, especially when subjects are "high risk" due to factors associated with poverty (Gustavson et al., 2012). The current sample was comprised of a majority of students who qualify for free or reduced lunch due to their poverty status. Therefore, it was expected that attrition would be significant over time. These attrition studies also suggest that when examining patterns of missing data, increased bias is introduced into statistical outcomes when baseline associations between variables is different between subjects that stay in the study and those that later dropout (Gustavson et al., 2012; Hafstad et al., 2013). In order to examine this in the current sample, correlation between baseline tier rating assignment and number of services was

conducted for those that remained in the sample at time five and those that did not.

Control and predictor variables. Demographic, service, and strength and need dummy variables were created for use in the multinomial regression analyses. The approach for preparing the data and for creating static dummy variables is described below.

Gender. Gender was coded as female (0), and male (1). Gender at baseline was used in all analyses.

Race/Ethnicity. Race/ethnicities were coded into four dichotomous dummy variables (does identify (1) or does not identify (0)). White students were the omitted group. Pacific Islander and Native American were collapsed into one category given that only one student identified as Pacific Islander. Race/ethnicity at baseline was used in all analyses.

ELL status. If students qualified as English Language Learners at some point during the five years, they were coded as 1.

SPED status. If students qualified for special education status at some point during the five-year timeframe, they were coded as 1.

Socioeconomic/Free-reduced lunch status (FRL). Consistent with previous studies, Free or reduced lunch status was used as a proxy for low socioeconomic status (Cruse & Powers, 2008; Walsh et al., 2014). If students qualified for free or reduced lunch status based on their family's income and federal income guidelines at any point during the five-year timeframe, they were coded as 1.

City Connects dosage at time one. Students had received, 0,1, 2, or 3 years of City Connects (i.e., dosage) at baseline in the current study. Three dichotomous dummy variables were created to represent dosage of 1, 2, or 3 years. Students who had received zero years of City Connects at time one were the omitted group.

Kindergarten or first grade at time one. A dichotomous dummy coded variable indicated whether students were in kindergarten (0) or first grade (1) at time one.

Mobility. A dichotomous dummy coded variable indicated whether students had moved (1) or not moved (0) schools at some point during the five years.

Services by domain. Average number of services by domain (academic, social-emotional, health, and family) were calculated. Though an average, static, variable can introduce error, this approach can also maximize the sample by adjusting for the variability in number of years students stayed in the intervention as well as for missing data. Discrete count variables were created (for use in chi-square analyses) to indicate whether a student had, on average, received 0-1, 2-3, or 4 or more services for each domain.

Strengths and needs by domain. Average number of strengths and average number of needs across time points was calculated for each of the four developmental domains using the count of strengths and needs text data.

Primary Analyses

Research Question One

Do the annual tier ratings/risk levels (Tier 1, 2a, 2b, and 3) of individual students change between first and fifth grade time points? What is the average number of times a student changes tier out of four possible changes between each of the five, time points? On average, what is the number of tier levels (-3, -2, -1,0, +1, +2, or +3) that change between time points and in what direction is the change (increasing or decreasing tier/risk level)?

In order to investigate research question one which was largely exploratory in nature, several tier variables were computed for each student. First, annual "intensity of tier change" was calculated for each student (e.g., Year 2 tier rating assignment – Year 1 tier rating assignment = Tier change 1). There were four "intensity of tier change" variables for each student given the four possible transitions between the five timepoints. Then, an average tier change variable was calculated by averaging the for "intensity of tier change" variables to determine whether, on average, students who changed tier, tended to increase or decrease tiers of risk and by how many tiers they increased or decreased. Next, a "number of tier changes" variable was calculated. To calculate this variable, any tier change intensity that was greater than or less than zero (indicating that a tier change did occur) a student was assigned a 1. These were added together to compute the total number of changes each student experiences out of four possible changes ((1) year 1->2, (2) year 2 ->3, (3) year 3 ->4, and (4) year 4 ->5).

Research Question Two

Are there characterizable patterns of holistic tier ratings over the course of the five sequential, elementary school years included in the current sample

such that there are discrete subgroups of students who have similar tier ratings at the same time points and similar direction of tier change (increase or decrease in tier) as well as intensity (number of levels of tier change) of tier change (i.e., Tier Change Profiles) between timepoints?

Prior to Repeated Measures Latent Class Analysis (RMLCA) model building, indicator variables were recoded for use in Mplus which requires a starting value of 1 for categorical/ordinal indicators. Indicator variables included tier ratings (1, 2a, 2b, and 3 coded as 1,2,3, and 4) at each time point and four tier transition variables (-3, -2, -1, 0, 1, 2, 3 coded as 1,2,3,4,5,6,7) indicating the intensity/number of levels of tier change between each of the five time points.

First, a RMLCA unconditional model (one class) was fit to the data and subsequently, the number of classes was increased by one and tested against a model with one fewer classes. Indices of model fit were examined at each step as classes were increased. This was repeated until the model deteriorated in fit indices.

Bayesian Information Criteria (BIC), and Akaike Information Criteria (AIC) were used to indicate the level of fit/misfit where the lower the values of AIC and BIC the better the model fit (Schwartz, 1978). Entropy, measured from zero to one, was examined to identify how well differentiated the classes were. Finally, the statistical significance (p-value) of Lo-Mendell-Rubem Likelihood Test (LMR, and the Bootstrap Likelihood Ratio Test (BLRT) were used to compare each model to the model with one fewer number of classes, such that significant p-values indicate a better fit than a model with one-fewer classes

(McLachlan & Peel, 2000). Finally, interpretability of the classes was considered. The broader latent class analysis literature indicates that there are often a few different models with a good-enough fit to the data but the interpretation, based in theory, should drive final model selection after fit indices have been assessed (Collins & Lanza, 2010; Raykov, 2016)

Research Question Three

Do students' number of identified social-emotional strengths and needs and number of social-emotionally focused services significantly impact their characterized pattern of tier ratings and tier change over the course of five years?

A three-step approach to examining covariates' relationship to class was used. In other words, the covariates were investigated only after the initial model was constructed during research question two's analyses. This approach has been cited as preferential to the one-step approach for exploratory social science studies, such as the current study, that wish to determine the relationship between latent class variables (tier rating) and multiple covariates/predictor variables (Asparouhov & Muthen, 2014; Hickendorff et al., 2017; McLachan & Peel, 2000; Vermunt, 2010).

Modal assignment to class. Following RMLCA analyses, students were assigned to a latent class using a modal approach. In a modal approach, participants are assigned to the latent class to which that they have the highest conditional probability of belonging (Goodman, 1974a; 2007). It should be noted that assigning students to modal class introduces some error to the data given that classes are not perfectly differentiated. Still, the approach has been used in

exploratory studies such as the current study, that don't seek to define a strict causal relationship between variables (see Hogan et al., 1993 or James et al., 2016). Further, in cases when the RMLCA model's entropy is higher than 0.8, which was the case in the current study, it has been found that the error is not excessive and "most-likely" class assignments are a satisfactory approach (Clark & Muthen, 2009).

A modal approach was considered adequate for the current study with the caveat that the results of association between variables should be considered estimates rather than definitive. Considerate of the potential error resulting from the modal class assignment approach, a conservative estimate of $p<.01$ rather than $p<.05$ was used to determine statistical significance in analyses addressing research question three (Clark & Muthen, 2009).

Services vs. strength/need analyses. The relationship between services and Tier Change Profile/Class, and strengths and needs and Tier Change Profile/Class, were examined in separate analyses. Strengths and needs assessments are conducted during WCR and therefore are one of the variables that lead to tier rating assignment. Therefore, a regression analysis is appropriate to determine the relationship between strengths and needs and tier as it implies some impact of strengths/needs on tier rating. Services, on the other hand, are delivered based on the WCR/tiering process making a non-causal analysis more appropriate for assessing its association with tier rating assignment. Further, if service information were to be introduced into a regression model there would be statistical issues of multicollinearity in the regression's predictor variables given

the correlation between services and strengths and needs. These conceptual and statistical reasons led to the decision to investigate research aim three through two separate analyses.

Chi-square analysis for service data. To test whether the number of social-emotional focused services is associated with characterized Tier Change Profile, a chi-square analysis was run with the average number of services for each domain and Tier Change Profile/Class. P-values for the chi-squared test statistic (X^2) of less than 0.01 were used to determine statistically significant associations between Tier Change Profile/Class and average number of services by domain. Standardized residuals of less than -2 or greater than 2 were used to determine the variables between which significant associations occurred. Hypotheses were assessed by examining associations between social-emotional services and class membership. Specifically, if there were a larger number of students receiving social-emotional services than expected in classes that demonstrated stable or decreasing tiers of risk, hypotheses would be confirmed.

Multinomial regression for strengths and needs. A multinomial logistic regression was run to assess the impact of strengths and need on Tier Change Profiles. Given the exploratory nature of the current analyses, background variables were included in the model in addition to strengths and needs to account for any variability associated with sample demographics and educational characteristics. A stepwise selection method of variable entry was utilized.

Background variables were static demographic variables including gender, race/ethnicity, socioeconomic status (as determined by eligibility for free/reduced

lunch at some point during the five included time points), whether a student was ever designated as an English language learner during the included timeframe and whether the student ever qualified for special education status during the included timeframe. Additional background variables included: dosage of City Connects at time one (number of years in the City Connects intervention at baseline), the student's grade at time one (kindergarten or first to account for any developmental impacts on patterns of tier ratings) whether the student ever repeated a grade, and whether a student ever changed schools during the studied time frame.

Strength and need variables of interest included average number of strengths by domain (academic, social-emotional, health, and family domains), and average number of needs by domain. These discrete (count) variables were treated as continuous for the purposes of this exploratory model. However, adequate regression model fit was not achieved with these count variables and therefore an alternative ratio approach to strength and needs variables was used and will be explicated in the results section.

Model fit was assessed using the log-likelihood chi-square test where a p-value of less than $p<0.05$ indicates that the model with predictors represents an improvement in fit over the null model, with no predictors. Goodness-of-fit was assessed through interpretation of the Pearson and Deviance statistics where non-significance indicates adequate fit (Tabatchnick & Fiddell, 2007). Finally, the variance accounted for by the predictors was assessed through interpretation of the McFadden pseudo R-squared statistic. The McFadden statistic is thought to be more conservative and accurate for multinomial logistic regression than the

alternatives of Cox and Snell and Nagelkerke statistics. While there is conflicting advice on thresholds for McFadden interpretation, a value between 0.2 and 0.4 is typically considered adequate (Hensher & Johnson, 1981; Tabatchnick & Fiddell, 2007).

P-statistics corresponding with parameter estimates were used to determine the statistical significance of covariates. A p-value of $p<0.01$ rather than <0.05 was used as the threshold for significance given the error associated with assigning students to modal latent Classes. Logit-odds (B) and odds ratios (Exp(B)) were both reported for ease of interpretation.

Chapter 4: Results

Preliminary Analyses

Missing Data

As is common in longitudinal studies, there were increasing attrition rates in each subsequent year of the current study. The number of students in the sample decreased over time such that out of the 1018 sample at baseline, 97.5% remained at time two, 92.1% remained at time three, 81.3% at time four and 60% at time five. Analyses of sample demographics at each time point revealed that at any given timepoint, between 6 and 13 percent of the sample had missing tier rating assignment data.

RMLCA analyses in MPlus statistically account for missing data using the Full Information Maximum Likelihood (FIML) method which depends on the assumption that data is Missing At Random (MAR). This assumption was verified through a correlation analysis comparing missing data with demographic data. These analyses revealed an association between missing data and special education status (more than the expected number of students who received special education status had missing data at time three), free and reduced lunch-status (lack of qualification for free or reduced lunch status was associated with less missing data than expected) and identifying as White (fewer than expected White students had missing data at time five). It should be noted that free and reduced lunch-status was the only demographic factor consistently associated with attrition and missingness across timepoints. This is consistent with prior studies that show that poverty-associated risk factors are associated with attrition. Further

this confirms that data is MAR and that FIML is an appropriate missing data strategy.

Baseline correlations between tier rating assignment and numbers of services were also conducted to determine whether students who remained in the sample at the end of the study differed at baseline from students who were lost to follow up. Both the students who were lost to follow up and those who remained in the sample at time five exhibited significantly positive Pearson correlations ($p<.001$) between tier rating assignment and number of services. Given thhese baseline correlations taken together with verification that data was MAR, FIML was considered adequate.

Static variables (e.g., number of services by domain) were calculated utilizing as many years of data as were available for each student and averaging across these available years, as described in the methods section. After these variables were created, four students (0.4% of the sample) were missing all service data and were removed from chi-square analysis and 16 (1.2%) were missing strengths and needs data and were removed from multinomial logistic analyses via list-wise deletion.

Tier measurement

In order to assure that tier rating assignment for the current sample was assigned in accordance with previous City Connects studies, tier rating assignment and service distribution (total number of services and total number of services by each intensity level) was assessed with the 908 students who had non-missing data for tier rating at baseline and non-missing data for services by each

tier intensity level at baseline. At baseline, 31.1% of students were in Tier 1, 26.8% were in Tier 2a, 17.6% were in Tier 2b, an 13.3% were in Tier 3, and 11% had missing tier rating data. These findings align with City Connects reports that show that annually, across districts, the greatest proportion of students are in Tier 1 or Tier 2a (minimal risk; around 30%-35%), and the smallest proportion are in Tier 3 (highest risk; around 10-15%).

These descriptive analyses also aligned with City Connects findings that tier ratings align with total number of services delivered such that students assigned a Tier 3 rating receive the greatest proportion of five or more services as well as the highest proportion of crisis services, as compared with other tier groups (see Table 4). This suggests tier rating in the current study is likely measured consistently with tier ratings in the City Connects fidelity and evaluation literature.

Table 4

Proportion of services by tier group at time one (N=908)

Number of Services	0-2	3-4	5 or more

Total Services*			
Tier 1	22.63%	25.91%	51.46%
Tier 2a	21.18%	24.71%	54.12%
Tier 2b	18.8%	21.72%	60.10%
Tier 3	11.05%	27.07%	61.88%
Enrichment Services			
Tier 1	61.19%	32.46%	6.34%
Tier 2a	60.32%	30.36%	9.31%
Tier 2b	51.83%	35.60%	12.57%
Tier 3	52.69%	32.34%	14.97%
Early Intervention			
Tier 1	64.98%	24.55%	10.47%
Tier 2a	57.48%	31.17%	11.34%
Tier 2b	58.12%	23.04%	18.85%
Tier 3	50.0%	28.31%	21.69%
Crisis Intervention			
Tier 1	99.63%	0.37%	0.00%
Tier 2a	96.76%	3.24%	0.00%
Tier 2b	89.53%	9.42%	1.05%
Tier 3	89.82%	8.38%	1.80%

**Total number of services was never equal to zero*

Description of covariates of interest

After composite variables were created, a descriptive analysis was conducted. Of the 1018 total students, 1014 students had non-missing service data and the 1002 students had non-missing strengths and needs data. Table 5 contains descriptive information for each of these variables.

Table 5

Covariate descriptive information

	Academic	Social-emotional	Health	Family
Avg N of services	1.58 (1.0)	1.34 (0.83)	1.90 (0.85)	1.24 (1.02)
Range	0-9.67	0-6	0-5	0-5.5
% of students receiving:				
0-1 services	48.4%	62.8%	25.4%	67.3%

2-3 services	46.2%	32.9%	68.2%	26.5%
3-4 services	5.4%	4.2%	6.3%	6.2%
Avg N of Strengths	2.15 (0.77)	2.12 (0.76)	1.78 (0.61)	1.56 (0.58)
Range	0-6	0-5	0-6	0-4.5
Avg N of Needs	1.47 (0.89)	1.33 (0.97)	0.72 (0.67)	0.85 (0.67)
Range	0-5	0-5.67	0-4.5	0-5

Note: Standard deviations are reported in parentheses

Strengths and needs were assessed for collinearity for their use in regression analyses. Significant correlations were found between number of strengths across domains, such that having more strengths in one domain was correlated with a higher number of strengths in another domain, and similarly a higher number of needs in one domain was correlated with a higher number of needs in another domain. Despite significant correlations between variables, it was decided to include the variables without further combination or summary given developmental science that posits the co-action and interaction of strengths and needs in development. These developmental theories suggest that, while this correlation between variables is understandable given that factors in development are heavily interrelated, their interaction is just as important as the patterns and similarities among them. The decision to keep strengths and needs variables separate (one strength and one need variable for each of the four developmental domains) was further supported by the lack of statistical assumptions about normality and linearity in multinomial regression analysis. This allows for less stringent criteria about variable inclusion and/or combination as long as there is a conceptual framework guiding decisions and model fit is deemed adequate.

Primary Analyses

Research aim one: describing tier change over time

Prior to investigating tier change over time, the percentage of students with each tier rating assignment at each time point was assessed. Table 6 presents these results as well as the proportion of students with missing tier data at each time point.

Table 6

Percentage of students in each tier

Tier	Time 1 N=1018	Time 2 N=993	Time 3 N=938	Time 4 N=828	Time 5 N=605
1	31.1%	30.3%	27.3%	27.4%	23.6%
2a	26.8%	24.6%	28.6%	32.9%	30.4%
2b	17.6%	20.5%	22.8%	21.6%	22.1%
3	13.3%	17.5%	13.3%	12.0%	11.2%
Missing	11.2%	7.1%	8.0%	6.1%	12.7%

On average between 50 and 60 percent of students changed tier each year between baseline and time five. In Table 7, the proportion of students who decreased or increased tier/risk level by three, two, or one tiers is displayed.

On average, the 417 students that had no missing tier data at all five consecutive time points made 2.20 (SD=1.19) or 55% of the possible four tier changes. For the 175 students that remained in the sample for only four consecutive years, and therefore, for only three consecutive transitions, the average number of tier changes was 1.5 (SD=0.95) or 50%, and for students who remained in the sample for three consecutive years and therefore for two transitions students made an average of 1.13 (SD=0.74), or 56% of two possible changes. Table 7 shows the proportion of students that exhibited each possible intensity and direction of tier change between time points.

Table 7

Tier change between timepoints

	Time 1-2 N= 861	Time 2-3 N= 818	Time 3-4 N= 700	Time 4-5 N= 481
Decreased tier/risk total	**20.3%**	**24.5%**	**28.2%**	**29.3%**
-3 tiers of risk	0.7%	1.2%	0.6%	1.0%
- 2 tiers of risk	3.1%	7.3%	4.3%	5.8%
- 1 tier of risk	16.1%	15.9%	23.3%	22.5%
No change in tier total	**41.6%**	**45.6%**	**46.0%**	**42.8%**
Increased tier/risk total	**23.1%**	**29.9%**	**25.8%**	**27.9%**
+ 1 tier of risk	14.4%	23.6%	21.0%	22.0%
+ 2 tiers of risk	7.4%	5.6%	4.4%	4.6%
+ 3 tiers of risk	1.3%	0.7%	0.4%	1.2%

Note: "decreased" suggests a change towards less risk and "increased" suggests a change towards more risk

Research aim one summary. The purpose of research aim one was to describe tier change over the course of five years. It was hypothesized that there would be variability in number of tier changes, direction of tier change and intensity (number of tier levels) of change in tier rating assignments over time. This hypothesis was confirmed by the current descriptive analyses. This analysis showed that students typically change tier between 50-56% of their total possible number of tier changes. This was consistent across students regardless of how many years (either three, four, or five years) they remained in the sample. More than 50% of students changed to a different tier rating of risk at each time point. The most commonly exhibited tier change was increasing or decreasing tier of risk by one tier. However, there were students that exhibited all possible intensities and directions of tier change (-3 to +3).

Research aim two: characterizing longitudinal Tier Change Profiles

Model building and fit. RMLCA used categorical indicators of tier ratings (1, 2a, 2b, or 3 coded 1,2,3,4) at each of the five time points, in addition to the number of levels of tier change (-3, -2, -1,0,1,2,3 coded as 7,6,5,4,3,2,1 for

MPlus) between time points. Model building began with an unconditional, one class model, adding one class at each step of model building until model fit statistics began to deteriorate. At four classes, model fit began to deteriorate (see Table 8 for model fit statistics at each phase of model building).

Table 8

Model fit statistics for Repeated Measures Latent Class Analysis

Number of classes	Entropy	AIC	BIC	LMR p-value	BLRT p-value
1	1	n/a	n/a	n/a	n/a
2	0.860	175987.0	17986.98	<.001	<.001
3	**0.936**	**16949.67**	**17545.81**	**<.001**	**<.001**
4	0.897	16612.59	17395.76	0.49	<.001

Note: Three classes (in bold), had the best overall model fit

Specifically, at four classes, the model did not converge as indicated by a failure to replicate the loglikelihood value even after the number of random starts were increased. This indicated that with four classes the model was mis-specified. This mis-specification was further substantiated by the LMR p-value increase from $p<0.001$ to 0.49 signifying that a model with one-less class was a better fit. In addition, the entropy decreased from a 3-class to a 4-class model signifying that classes became less differentiated. While the AIC and BIC continued to decrease from the 3-class to the 4-class model both statistics decreased less than they did when moving from a 2-class to 3-class model. Taken together with the decreasing entropy and non-significant LMR p-value, it is unlikely that the decreases in AIC and BIC are meaningful. In addition to a more statistically optimal model in terms of fit, the three-class model also allowed for meaningful interpretation of class composition.

Tier Change Profile/Class descriptions. Upon examining the tier rating and tier change indicators for each class, it was found that Class 1 was composed of 247 students who were most likely to be rated as Tier 1 at each time point and were most likely to experience little to no change between all-time points (see Figure 1, Figure 2, and Table 9 for descriptions of Class by average tier rating and by probability of exhibiting each intensity of tier change).

Meanwhile, Class 2 was characterized by 349 students who had the greatest likelihood of being assigned to Tier 2a at each time point in addition to showing volatility in tier change during the first half of the study (between kindergarten through second grade for the kindergarten cohort and first through third grade for the first grade cohort), followed by more stability in tier ratings in the second half of the study. Specifically, between time one and time two, students in Class 2 were most likely to decrease tier rating assignment by 1, 2, or 3 tiers, and then between time two and time three, they were most likely to increase tier rating assignment by 1, 2, or 3 tiers. However, between time three and four and time four and five these students exhibited a more even distribution of direction of tier change (both increase and decrease in tier rating assignments) and this change was most likely to be by only one tier in either direction (see Figure 1, Figure 2, and Table 9 for descriptions of Class by average tier rating and by probability of exhibiting each intensity of tier change).

Finally, Class 3 were 422 students who had the greatest likelihood of being rated Tier 2b or Tier 3 throughout the five time points. Students in Class 3 exhibited the highest volatility in tier change between all studied time points.

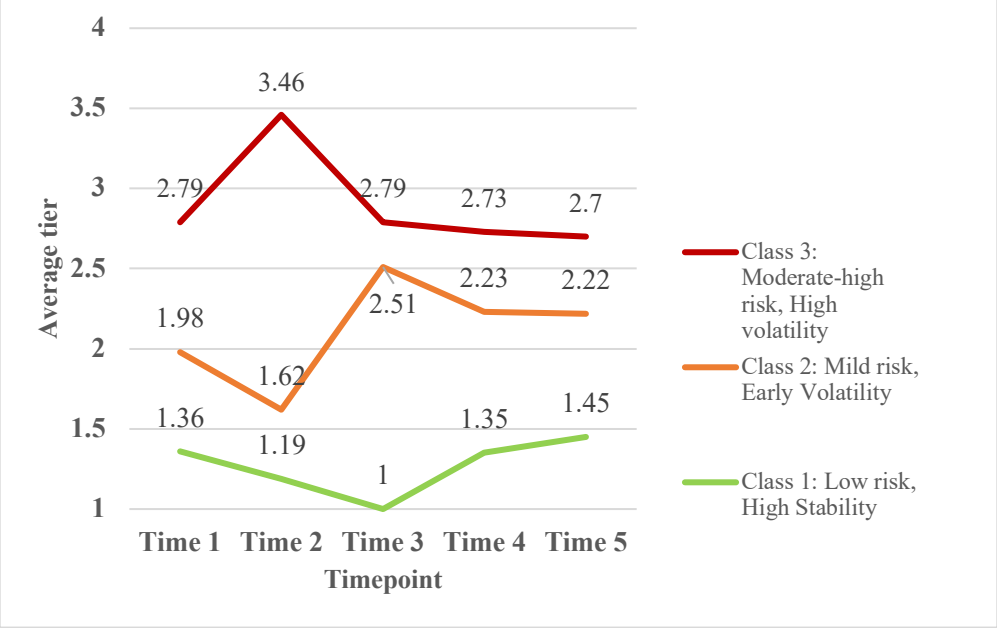
Specifically, their tier ratings were most likely to increase between time one and time two, then decrease between time two and three, and then to exhibit all possible intensities and directions of change between time three and four, and time four and five. While there were students who remained with the same tier rating assignment of 2b or 3 at each time point, students in Class 3 who did change tier, did so with more variable direction and intensity than students in the other two Classes (see Figure 1, Figure 2, and Table 9 for descriptions of Class by average tier rating and by probability of exhibiting each intensity of tier change).

Tier Change Profile Names. After examining the probabilities of being in each class associated with each indicator variable, the Tier Change Profiles/Classes were labeled, Class 1: Low risk, high stability, Class 2: Mild risk, early volatility and late stability, and Class 3: Moderate-High risk, high volatility. The three Classes represented three distinct Tier Change Profiles and therefore the terms will be used interchangeably.

Class 1 was comprised of 24.3% of the sample (N=247), Class 2 was comprised of 34.3% of the sample (N=349), and Class 3 was comprised of 41.5% of the sample (N=422). Class 1 was the best differentiated in that students who belonged to Class 1 had a high likelihood of belonging to Class 1 and a low likelihood of belonging to Class 2 and 3. However, there was less differentiation between Class 2 and 3 which were also the more volatile Tier Change Profiles/Classes in terms of the direction and intensity of exhibited tier change. It is likely this volatility contributed to the decreased differentiation between Class 2 and 3 Tier Change Profiles.

Figure 1

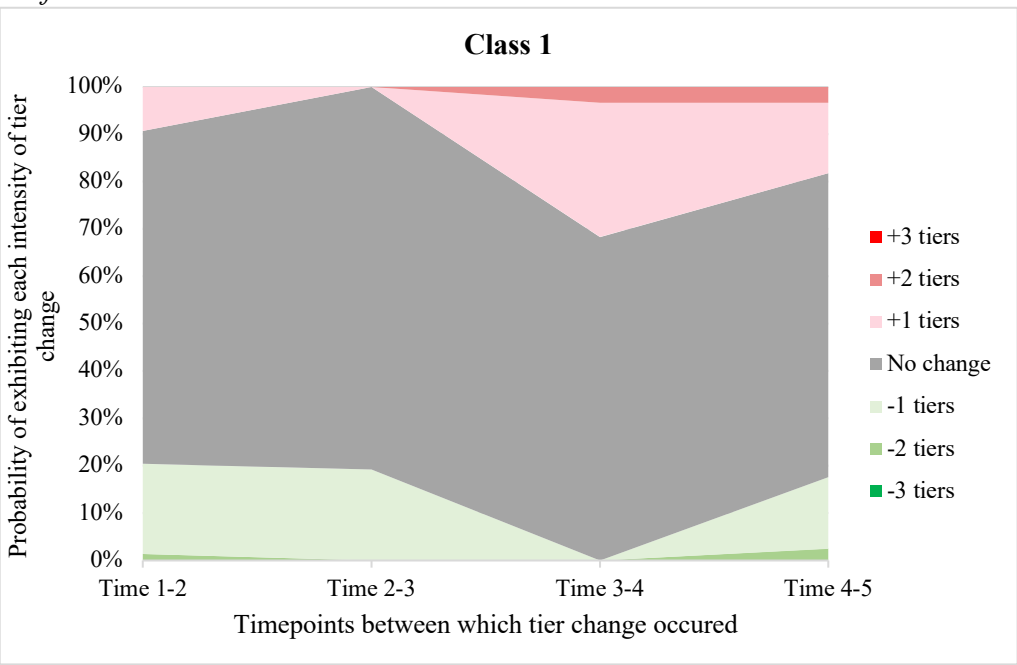
Average tier rating by Class/Tier Change Profile

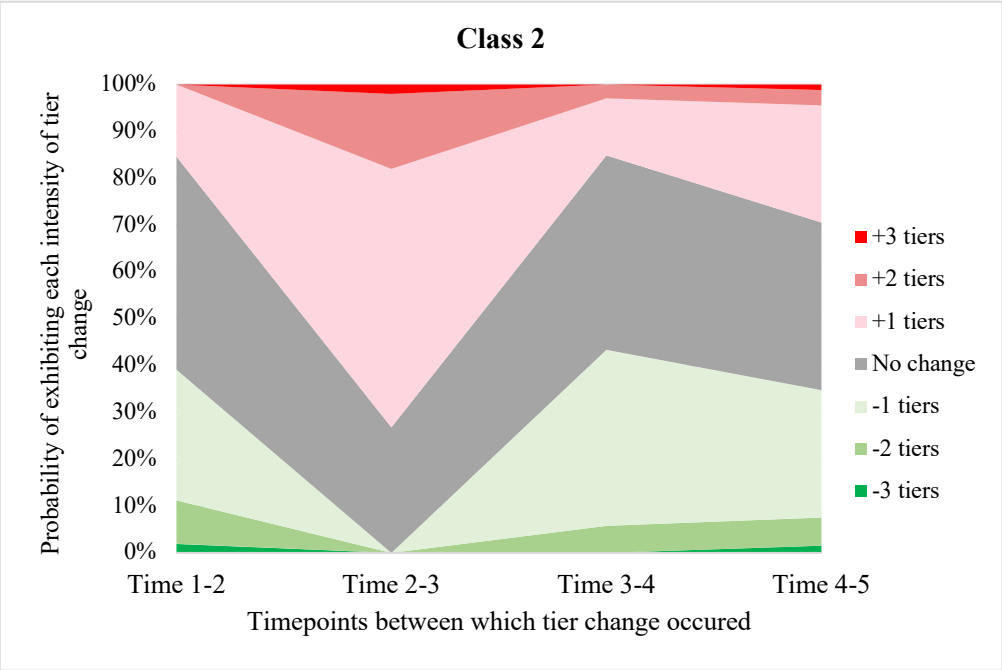


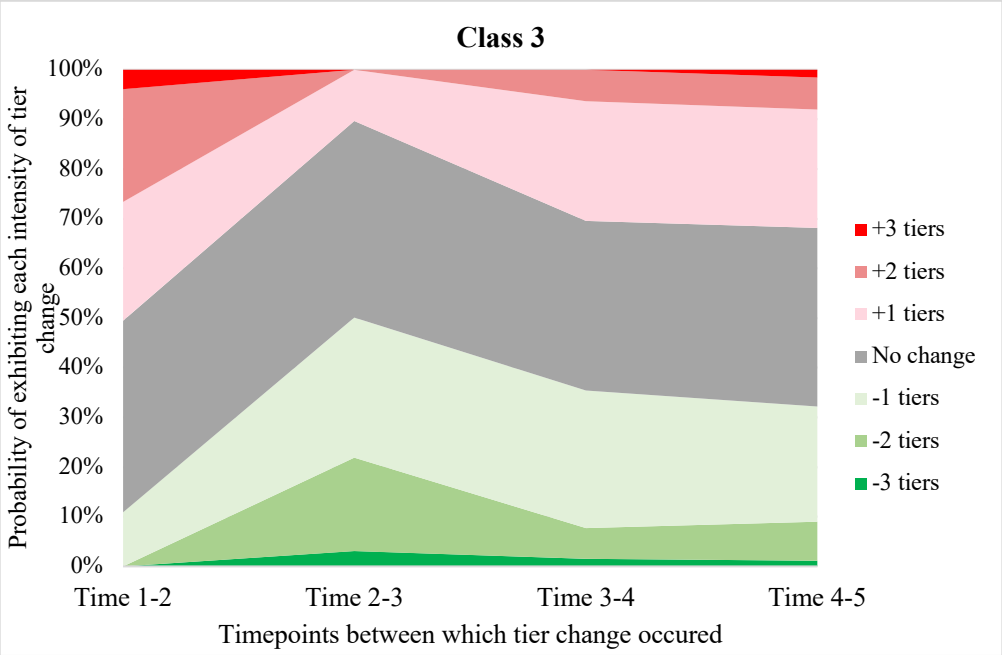
Note: On the y-axis (average tier), 1=Tier 1, 2=Tier 2a, 3=Tier 2b, and 4=Tier 3

Figure 2

Probability of exhibiting each intensity of tier change by Class/Tier Change Profile







Note: The shaded areas at each of the labeled Times on the x-axis (i.e., Time 1-2, Time 2-3, Time 3-4, and Time 4-5) represent the probability out of 100% of exhibiting each of the possible intensities of tier change. Each color represents a different tier change intensity which is defined in the legend on the right hand side of the graphs.

Table 9

Tier rating and tier change descriptions of each Class/Tier Change Profile

	Class 1: Low risk, high Stability N=247		Class 2: Mild risk, early volatility, later stability N=349		Class 3: Moderate-high risk, high volatility N=422	
Tier rating	Mean	SD	Mean	SD	Mean	SD
Time 1	1.36	0.58	1.98	0.91	2.79	1.03
Time 2	1.19	0.39	1.62	0.49	3.46	0.49
Time 3	1.00	0.01	2.51	0.67	2.79	0.97
Time 4	1.35	0.56	2.23	0.90	2.73	0.91
Time 5	1.45	0.63	2.22	0.89	2.70	0.92
Tier Change						
Time 1-2	N=222		N=310		N=329	
-3 tiers of risk	0.5%		1.9%		0%	
- 2 tiers of risk	1.4%		9.4%		0%	
- 1 tier of risk	18.5%		28.1%		10.9%	
No change	71.2%		44.8%		38.3%	
+ 1 tier of risk	8.6%		15.8%		24.0%	
+ 2 tiers of risk	0%		0%		22.8%	
+ 3 tiers of risk	0%		0%		4.0%	
Time 2-3	N=212		N=288		N=318	
-3 tiers of risk	0%		0%		3.1%	
- 2 tiers of risk	0%		0%		18.9%	
- 1 tier of risk	18.7%		0%		28.3%	
No change	81.3%		26.4%		39.3%	
+ 1 tier of risk	0%		55.6%		10.4%	
+ 2 tiers of risk	0%		16.0%		0%	
+ 3 tiers of risk	0%		2.1%		0%	
Time 3-4	N=193		N=248		N=262	
-3 tiers of risk	0%		0%		1.5%	
- 2 tiers of risk	0%		5.6%		6.1%	
- 1 tier of risk	0%		37.5%		27.5%	
No change	67.9%		41.5%		34.0%	
+ 1 tier of risk	28.5%		12.1%		23.7%	
+ 2 tiers of risk	3.1%		3.2%		6.5%	
+ 3 tiers of risk	0.5%		0%		0.8%	

Time 4-5	N=120	N=163	N=198
-3 tiers of risk	0%	1.8%	1.0%
- 2 tiers of risk	2.5%	5.5%	8.1%
- 1 tier of risk	14.2%	27.6%	23.2%
No change	64.2%	35.0%	36.4%
+ 1 tier of risk	15.0%	25.8%	23.2%
+ 2 tiers of risk	3.3%	3.1%	6.6%
+ 3 tiers of risk	0.8%	1.2%	1.5%

Note: Tiers are represented on a 1-4 scale where Tier 1=1, Tier 2a=2, Tier 2b=3, and Tier 3=4

Research aim two summary. Research aim two sought to characterize patterns in tier rating and tier change over time (i.e., Tier Change Profiles). Hypotheses were that (1) there would be identifiable longitudinal Tier Change Profiles, (2) that one such Profile would be students who initially received a low tier rating of risk (Tier 1) and remained at low tiers of risk, (3) that another Profile would be students who started at and remained at high risk (Tier 3), and (4) that students at Tier 2a and 2b would exhibit significant variability in tier rating but would generally show decreases in tier rating of risk. These hypotheses were accepted in part.

There were evident Tier Change Profiles of students who received low tier/risk ratings and remained at low tier/risk ratings (Class 1- low risk, high stability). However, students who received high tier/risk ratings (Tier 3) at time one did not entirely exhibit the hypothesized stability. Instead, while students who received an initial tier rating of Tier 3 tended to remain in higher tiers, they also exhibited the most consistent variability in tier change over time (Class 3 – high risk, high volatility). Meanwhile it was hypothesized that Tier 2a and 2b would exhibit the highest variability in tier ratings and tier change and on average, tier/risk rating would decrease. While this variability, but not the decrease in tier,

was true of students who were assigned a Tier 2b rating, who had a similar Tier Change Profile to students who received a Tier 3 rating assignment at baseline (Class 3 – high risk, high volatility), students who received a tier rating assignment of Tier 2a at baseline were in a separate Class from Tier 2b and 3 and exhibited initial volatility and later stability in tier rating assignment (Class 2- mild risk, early volatility).

Research aim three: social-emotional/behavioral factors and tier ratings

Covariate descriptions of Tier Change Profiles. Prior to assessing research aim three, the demographic, service, and strength/need variables were described for each Tier Change Profile/Class. Table 10 describes each Tier Change Profile/Class via demographic, dosage, and grade at baseline. Tables 11 and 12 include descriptions of each Tier Change Profile/Class via service and strength and need variables.

Table 10

Percentage of students in each covariate category by Tier Change Profile/Class

	Class 1: Low risk, high stability	Class 2: Mild risk, Early volatility, later stability	Class 3: Moderate-high risk, high volatility
Covariates	N=247	N=349	N=422
Demographic variables			
Male	38.5%	51.0%	60.0%
Ethnicity			
White	8.1%	6.3%	5.2%
Black	15%	16.9%	19.7%
Latinx	73.3%	73.9%	72.5%
Asian	2.4%	1.7%	0.7%
Pacific Is./Native	1.2%	1.1%	1.9%
Ever free/reduced lunch	87%	91.7%	96.7%
Ever special education	4.5%	13.8%	35.5%
Ever ELL	23.1%	27.8%	27.7%

Grade at baseline			
Kindergarten	63.2%	49.9%	53.3%
1st grade	36.8%	50.1%	46.7%
Ever repeated a grade	3.6%	12.6%	22.5%
Ever changed schools	17.0%	22.3%	32.7%
Dosage at baseline			
0 years	55.9%	57%	66.8%
1 year	28.3%	27.5%	23.7%
2 years	12.6%	14.3%	8.5%
3 years	3.2%	1.1%	0.9%

Table 11

Number of services and strength/needs by Tier Change Profile/Class

	Class 1: Low risk, high Stability N=245		Class 2: Mild risk, early volatility, later stability N=349		Class 3: Moderate-high risk, high volatility N=420	
	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	Range
Services						
Academic	1.33 (0.75)	0-4	1.51 (0.94)	0-6	1.79 (1.12)	0-10
Soc/Emot	1.19 (0.76)	0-6	1.23 (0.72)	0-4	1.49 (0.93)	0-5
Health	1.84 (0.83)	0-5	1.90 (0.82)	0-6	1.94 (0.88)	0-5
Family	1.16 (0.96	0-4	1.28 (1.02)	0-4	1.25 (1.05)	0-5
Strengths						
Academic	2.44 (0.86)	1-6	2.15 (0.69)	1-5	1.99 (0.72)	1-5
Soc/Emot	2.44 (0.78)	1-5	2.11 (0.72)	1-5	1.93 (0.71)	1-5
Health	1.82 (0.67)	1-6	1.81 (0.59)	1-4	1.74 (0.59)	1-4
Family	1.75 (0.54)	1-4	1.68 (0.59)	1-4	1.58 (0.58)	1-4
Needs						
Academic	0.79 (0.65)	0-4	1.41 (0.75)	0-4	1.91 (0.85)	0-5
Soc/Emot	0.73 (0.60)	0-3	1.28 (0.84)	0-5	1.71 (1.07)	0-6
Health	0.43 (0.41)	0-2	0.69 (0.63)	0-4	0.91 (0.75)	0-5
Family	0.54 (0.52)	0-3	0.82 (0.59)	0-3	1.07 (0.73)	0-5

Table 12

Percentage of students receiving number of services in each Class

	Class 1: Low risk, high Stability	Class 2: Mild risk, early volatility, later stability	Class 3: Moderate-high risk, high volatility
	N=245	N=349	N=420
Academic			
0-1 services	61.6%	48.4%	40.7%
2-3 services	37.1%	47.6%	50.2%
4 or more services	1.2%	4.0%	9.0%
Social-emotional			
0-1 services	71.0%	65.3%	56.0%
2-3 services	25.3%	33.0%	37.4%
4 or more services	3.7%	1.7%	6.7%
Health			
0-1 services	24.1%	25.8%	26.0%
2-3 services	69.8%	69.6%	66.2%
4 or more services	6.1%	4.6%	7.9%
Family			
0-1 services	72.7%	66.8%	64.5%
2-3 services	22.4%	26.9%	28.6%
4 or more services	4.9%	6.3%	6.9%

Chi square analysis with number of services. There were significant associations between Tier Change Profiles and number of academic services ($\chi 2 = 39.38$, $p<0.001$). Class 1 (low risk, high stability) had more students who received an average of 0-1 services than expected and fewer students than expected received 2-3 services, and 4 or more services, in the academic domain. Class 3 (high risk, high volatility) had fewer than expected students who received an average of 0-1 services and a larger than expected number of students receiving 4 or more services in the academic domain.

Significant associations were also found between Tier Change Profiles/Class and social-emotional services ($\chi 2 = 24.22$, $p<0.001$). In Class 1

(low risk, high stability), fewer than expected students received an average of 2-3 services in the social-emotional domain. In Class 2 (mild risk, early volatility), fewer than expected students received an average of 4 or more services in the social-emotional domain. In Class 3 (high risk, high volatility), larger than expected number of students received an average of 4 or more services in the social-emotional domain.

No significant associations were found between number of health services and Tier Change Profile/Class ($p=0.42$) or number of family services and Tier Change Profile/Class ($p=0.312$).

Multinomial logistic regression with strengths/needs. A multinomial logistic regression analysis determined whether number of strengths and needs impacted likelihood of exhibiting one of the three identified Tier Change Profile as compared with another.

Model fit. Chi-square likelihood ratio tests showed that there was a significant relationship between the dependent variable, Tier Change Profiles/Classes, and the covariates ($\chi 2 = 604.75$, $p<.001$). Goodness-of-fit statistics showed that while the deviance statistic was adequate ($p=1.00$), the Pearson $\chi 2$ value was significant ($p<0.001$) indicating that the model was an inadequate fit.

Strength and need ratio variables. In order to adjust for this inadequate fit, strength and need variables were combined into a composite variable that indicated whether a student had the same average number of strengths and needs, a larger average number of strengths than needs, or a larger average number of needs than strengths in each domain. Having equal numbers strengths and needs

was used as the omitted category for the regression analysis. Table 13 describes this new strengths and needs variable by Tier Change Profile/Class.

Table 13

Strengths/needs by domain and by Tier Change Profile/Class

	Class 1: Low risk, high stability	Class 2: Mild risk, Early volatility, later stability	Class 3: Moderate-high risk, high volatility
Covariates	N=243	N=348	N=420
Academic			
Strengths=Needs	2.1%	9.2%	11.7%
Strengths > Needs	95.8%	72.3%	49.8%
Needs > Strengths	2.1%	18.4%	38.6%
Social-emotional			
Strengths=Needs	2.9%	8.3%	8.4%
Strengths > Needs	95.5%	72.3%	56.1%
Needs > Strengths	1.6%	15.8%	35.6%
Health			
Strengths=Needs	1.7%	3.7%	7.4%
Strengths > Needs	96.6%	88.5%	76.6%
Needs > Strengths	1.7%	7.7%	16.0%
Family			
Strengths=Needs	2.5%	8.0%	9.3%
Strengths > Needs	91.7%	75.9%	65.5%
Needs > Strengths	5.8%	13.5%	25.2%

Note: percentages do not always add up to 100% due to missing data

Model fit was then reassessed. Likelihood ratio tests demonstrated that there was a significant relationship between dependent and independent variables and that the model with the predictors represented a significant improvement in fit as compared with the null-model ($\chi 2 = 453.16$, $p<.001$). Both Pearson ($p=0.29$) and deviance ($p=1.00$) goodness-of-fit statistics indicated adequate fit. McFadden

pseudo R-square value indicated a 21% improvement in fit with the predictors as compared to the null model.

Multinomial regression results. For reasons related to modal assignment of Tier Change Profile/Class, a conservative p-value of less than or equal to 0.01 was used as the threshold of significance. Table 14 displays regression results where coefficients represent the logit-odds of being in the indicated Tier Change Profile/Class relative to the reference Tier Change Profile/Class for a one unit increase in the predictor variable when other variables are held constant. In other words, in Table 14, the multinomial logistic regression coefficient (B) for the "male" variable for Class 2 (mild risk, early volatility) versus Class 1 (low risk, high stability) can be interpreted as, when a student is male as opposed to female, the log-odds for belonging to Class 2 relative to Class 1 would be expected to increase by 0.36 when holding all other variables constant. Table 15 includes the odds-ratios for each of the variables for ease of interpretation. In this table, the odds-ratio for the "male" variable can be interpreted as, male students were 1.44 times as likely as female students to be in Class 2 as opposed to Class 1.

Table 14

Multinomial regression results in log-odds (B)

Variables	Class 2 vs 1			Class 3 vs 1		
	B	SE	p-val	B	SE	p-val
Background var.						
Male	0.36	0.19	0.06	0.44	0.21	0.04
Ethnicity						
Black	0.02	0.43	0.96	0.34	0.49	0.49
Latinx	0.18	0.38	0.63	0.38	0.44	0.39
Asian	0.15	0.70	0.84	-0.13	0.93	0.89
Pacific Is./Native	0.31	0.92	0.73	0.93	0.96	0.44
*Free/reduced Lunch	0.52	0.32	0.10	**1.29**	**0.42**	**.002**

*Special education	**0.94**	**0.37**	**0.01**	**1.99**	**0.36**	**<.001**
ELL	0.14	0.22	0.53	0.12	0.24	0.64
*1st grade at time 1	**0.60**	**0.20**	**0.002**	**0.39**	**0.22**	**0.08**
*Ever repeated grade	**1.1**	**0.42**	**0.01**	**1.51**	**0.42**	**<.001**
Ever changed schools	0.03	0.24	0.92	0.32	0.26	0.21
Dosage at baseline						
1 year	-0.25	0.22	0.26	-0.47	0.24	0.06
2 years	0.04	0.29	0.89	-0.50	0.34	0.15
3 years	-0.66	0.66	0.32	-0.59	0.75	0.43
Strengths and Needs						
Academic						
*Strengths > Needs	**-1.60**	**0.55**	**0.004**	**-2.01**	**0.56**	**<.001**
Needs > Strengths	0.50	0.72	0.49	0.86	0.72	0.24
Social-emotional						
*Strengths > Needs	**-1.36**	**0.49**	**0.006**	**-1.50**	**0.51**	**0.004**
Needs > Strengths	0.91	0.71	0.20	1.67	0.72	0.02
Health						
Strengths > Needs	-0.68	0.65	0.15	-1.30	0.67	0.05
Needs > Strengths	0.29	0.86	0.74	0.11	0.87	0.90
Family						
Strengths > Needs	-0.71	0.50	0.16	-0.74	0.51	0.16
Needs > Strengths	-0.10	0.59	0.86	0.43	0.61	0.49

	Class 2 vs 3		
Variables			
	B	SE	p-val
Background var.			
Male	-0.08	0.16	0.65
Ethnicity			
Black	-0.32	0.39	0.41
Latinx	-0.20	0.36	0.58
Asian	0.27	0.85	0.75
Pacific Is./Native	-0.61	0.74	0.41
*Free/reduced Lunch	-0.77	0.36	0.04
*Special education	**-1.05**	**0.20**	**<.001**
ELL	-0.03	0.18	0.89
*1st grade at time 1	0.22	0.17	0.20
*Ever repeated grade	-0.46	0.22	0.04
Ever changed schools	-0.29	0.19	0.12

Dosage at baseline			
1 year	0.22	0.19	0.26
2 years	0.54	0.27	0.05
3 years	-0.08	0.76	0.92
Strengths and Needs			
Academic			
*Strengths > Needs	0.41	0.27	0.12
Needs > Strengths	-0.36	0.29	0.22
Social-emotional			
*Strengths > Needs	0.15	0.29	0.62
Needs > Strengths	-0.76	0.32	0.02
Health			
Strengths > Needs	0.62	0.40	0.12
Needs > Strengths	0.18	0.46	0.70
Family			
Strengths > Needs	0.02	0.31	0.92
Needs > Strengths	-0.53	0.35	0.13

An asterisk (*) indicates a significant p-value of less than 0.01 on at least one comparison and bolded text indicates where the significant comparison occurred

Table 15

Multinomial regression results odds-ratios

Variables	Class 2 vs 1	Class 3 vs 1	Class 2 vs 3
Background variables			
Male	1.44	1.55	0.93
Ethnicity			
Black	1.02	1.44	0.73
Latinx	1.20	1.47	0.82
Asian	1.12	0.88	1.32
Pacific Is./Native	1.37	2.53	0.54
Free/reduced Lunch	1.69	3.63**	0.47
Special education	2.56*	7.28**	0.35**
ELL	1.15	1.12	1.02
1st grade at time 1	1.83*	1.47	1.24
Ever repeated grade	2.88*	4.54**	0.63
Ever changed schools	1.03	1.38	0.75
Dosage at baseline			
1 year	0.78	0.63	1.25

2 years	1.04	0.61	1.71
3 years	0.52	0.56	0.93
Strengths and Needs			
Academic			
Strengths > Needs	0.19*	0.13**	1.51
Needs > Strengths	1.63	2.37	0.70
Social-emotional			
Strengths > Needs	0.26*	0.22*	1.16
Needs > Strengths	2.48	5.32	0.47
Health			
Strengths > Needs	0.51	0.27	1.87
Needs > Strengths	1.34	1.12	1.20
Family			
Strengths > Needs	0.49	0.48	1.03
Needs > Strengths	0.90	1.53	0.59

*An asterisk (*) indicates a p-value less than 0.01, and ** indicates a p-value less than 0.001*

Regression results indicated that students who qualified for special education at least once during the study were more likely than students who did not qualify for special education to be in Class 2 (mild risk, early volatility) than Class 1 (low risk, high stability) ($p=0.007$), less likely to be in Class 2 than Class 3 (moderate-high risk, high volatility) ($p<0.001$), and more likely than students who did not qualify for special education to be in Class 3 (high risk, high volatility) than in Class 1 (low risk, high stability) ($p<.001$). Grade at baseline also impacted Tier Change profile such that students who were in first grade at baseline were more likely than students who were in kindergarten at baseline to be in Class 2 (mild risk, early volatility) than in Class 1 (low risk, high stability) ($p=0.002$). Students who repeated a grade at least once were more likely to be in Class 2 (mild risk, early volatility) than Class 1 (low risk, high stability) ($p=0.01$), and more likely to

be in Class 3 (high risk, high volatility) than Class 1 (low risk, high stability) ($p<0.001$). Students who qualified for free or reduced lunch at some point during the five years were more likely to be in Class 3 (high risk, high volatility) than in Class 1 (low risk, high stability) that students that did not qualify for free or reduced lunch($p<0.001$).

In terms of strengths and needs variables, students who, on average, had more strengths than needs in the academic domain were less likely to be in Class 2 (mild risk, early volatility) than Class 1 (low risk, high stability) ($p=0.002$) and less likely to be in Class 3 (high risk, high volatility) than Class 1 (low risk, high stability) ($p<0.001$). Students who, on average, had higher numbers of identified strengths than needs in the social-emotional domain, were less likely to be in Class 2 (mild risk, early volatility) than Class 1 (low risk, high stability) ($p=0.007$) and less likely to be in Class 3 (high risk, high volatility) than in Class 1 (low risk, high stability) ($p=0.004$).

Disaggregation of special education status. The multinomial regression results indicated special education status was a significant predictor of Tier Change Profile. A disaggregated variable that indicated the amount of time a student required for special education services was substituted for the dichotomous (no/yes) special education variable in the regression model. This disaggregation was included in regression analyses to better understand whether there were differences in likelihood of exhibiting the three different Tier Change Profiles based on severity of special education. This disaggregated special education variable included categories of: (1) never qualified for special education

(79.8% of the sample), (2) regular education with modification (e.g., 504 plan) (7.5% of the sample), (3), mild to severe special education (6.5% of the sample), and (4) substantially separate (6.3% of the sample). Dummy variables were created with non-special education used as the omitted category.

Likelihood ratios of the regression model with the disaggregated special education variable indicated that the model with the predictors represented a significant improvement in fit as compared with the null-model (no predictors) ($\chi 2=445.48$, $p<0.001$) and goodness of fit statistics showed non-significant p-values of 0.422 and 1.0 for Pearson and Deviance statistics respectively. McFadden pseudo-R-square value indicated a 21% improvement in fit with the predictors as opposed to the null model which was the same value as the model with the aggregated special education variable.

Regression analyses with disaggregated special education data showed no significant impact of special education statuses on membership to Class 1 (low risk, high stability) as compared with Class 2 (mild risk, early volatility) ($p>0.05$). However, all special education statuses were significant in terms of increasing likelihood of membership to Class 3 (moderate-high risk, high volatility) as compared to Class 1 (low risk, high stability) ($p<.005$) and Class 2 (mild risk, early volatility) as compared with Class 3 (high risk, high volatility) ($p<0.006$) such that students who qualified for any level of special education were significantly more likely to be in Class 3 (high risk, high volatility) than Class 1 (low risk, high stability), and to be in Class 3 (high risk, high volatility) as opposed to Class 2 (mild risk, early volatility).

Research aim three summary. Results and hypotheses for research aim three regarding the impact of social-emotional services and social-emotional strengths and needs on Tier Change Profile were dependent on research question two's analyses about classification of tier rating and change patterns over time. Results from research aim two revealed that only one of the three initially hypothesized Tier Change Profiles was confirmed – specifically, that students at low tier ratings of risk showed stability in tier rating and tier change over time (Class 1). It was found that students with more social-emotional strengths than needs were more likely to be in Class 1 (stable, low risk) than in Classes 2 and 3 (higher risk and higher volatility). The same pattern of results was found for having more academic strengths than needs. Having more social-emotional needs than social-emotional strengths was not found to be predictive of stable or decreasing patterns of tier change and tier ratings as predicted, and nor was having a higher number of academic strengths than needs.

There were certain background characteristics that were also predictive of Class. It was found that students who received free/reduced lunch at one or more time points were more likely to be in Class 3 which was associated with higher risk and more volatile tier change over time, than Class 1 which was associated with low risk and less change over time. Special education status was also predictive of being in higher tiers of risk and experiencing more volatile tier change indicated by a higher probability of being in Class 3 than Class 2 or Class 1, and a higher probability of being in Class 2 than Class 1. Being in first grade as opposed to kindergarten at time one was also predictive of being in Class 2

(mild risk, early volatility) as opposed to Class 1 (low risk, high stability), and repeating a grade was predictive in being rated at higher tiers of risk and experiencing more volatile tier change (i.e., being in Class 2 and Class 3 as opposed to Class 1).

In terms of social-emotionally focused services, hypotheses were that there would be an association between having a higher number of social-emotional services and having stable or decreasing patterns of tier ratings. This was not supported. Instead, it was found that there were significant associations between higher numbers of social-emotional services and Tier Change Profile, indicating a relationship between increasing risk and increasing average number of social-emotional services. Specifically, Class 1 (low risk, high stability) had fewer than expected numbers of students receiving two or three social-emotional services, and in Class 2 (mild risk, early volatility), fewer than expected students received four or more social-emotional services. In Class 3 (high risk, high volatility), larger than the expected number of students received four or more services in the social-emotional domain.

Similar patterns were found for academic services with a few differences. These differences were that, in Class 1 (low risk, high stability), higher than expected numbers of students received zero or one services, fewer than expected students received four services, and fewer than expected number of students received two to three academic services, only the last of which was true for social-emotional services as well. There were no significant findings for Class 2 (mild risk, early volatility) with regards to academic services. In parallel to social-

emotional findings, there were higher than expected numbers of students who received 4 or more services in Class 3 (high risk, high volatility) with the additional finding that there were fewer than expected number of students received 0-2 services in Class 3. No significant associations between health and family domains and services were found.

Taken together, while significant associations between a higher number of social-emotional services and stable Tier Change Profiles were not found, the data does indicate a more even distribution of number of social-emotional services across Tier Change Profiles/Classes than was found for academic services which increased more consistently in number as tier/risk rating and tier change volatility increased.

Chapter 5: Discussion

The current chapter includes a review and discussion of overall findings as well as for each of the three research aims. Practice implications and limitations of the current study are then offered followed by recommendations for future research.

Findings

This is the first known study to examine a tiered intervention tool from a longitudinal and within-student perspective. The ISS intervention of focus in the current study, City Connects, serves primarily low income, communities of color. Poverty and race are associated with "high risk" samples, since they are predictors of systemic inequality, limited access to critical resources, and experiences of oppression (Darling-Hammond, 2014; Milner, 2013; Roy & Raver, 2014). The City Connects school district examined in the current study reflects these "high-risk" characteristics. The vast majority of the sample received Free or Reduced Lunch at one or more time points and the two most prominent racial/ethnic identifications were Latinx and Black. Therefore, the current results should be considered in the context of these demographically high-risk lenses. It should also be cautioned that this is an exploratory examination. Still, the results provide important contributions to existing literature about tier. A brief overview of these contributions are highlighted below followed by an in-depth discussion of each of the three research aims.

Highlights

The longitudinal Tier Change Profiles found in the outcomes of the current study are quite distinct from academic and social-emotional City Connects outcomes. Previous studies on the effectiveness of City Connects in the school district of focus in the current dissertation show positive academic and behavioral outcomes. One might think that, in parallel, individual student Tier Change Profiles would show decreases in risks for all students regardless of tier rating. Instead, Tier Change Profiles highlight trajectories that align with developmental science such that students who face the highest level of risk, demonstrate general consistency in their high tier/risk rating assignment as well as unpredictability in tier rating change assignment over time. This does not necessarily mean that these students are not experiencing the positive academic and social-emotional impacts of the intervention. Rather, it is possible that Tier Change Profiles signify something different from intervention outcomes.

For instance, students who exhibit Tier Change Profiles characterized by high levels/intensity of risk and high volatility may have exposure to the kinds of risk that cannot be completely addressed by a school-based intervention (e.g., exposure to community violence). Alternatively, these students might experience stable risk factors (e.g., special education status due to a mental health diagnosis). City Connects outcome studies would suggest that these highest at-risk students likely still experience the positive impacts of the interventions (see City Connects, 2020). Therefore, their Tier Change Profiles tell a separate and perhaps more developmental story of individual student strengths and risks as they interact with

the intervention, their out-of-school contexts, and their physical and mental development.

The research in developmental science that examines risk and protective factors is also critically helpful in framing the results of the current study. This is especially relevant for the finding that having a larger number of strengths than risks in the social-emotional and academic domains was predictive of exhibiting a Tier Change Profile characterized by lower tiers/risk level. City Connects assigns tier ratings based on an assessment of strength/risk levels citing the protective impact of strengths in development. Student strengths are supported and enriched by services in and out of school regardless of level/intensity of risk. While the importance of intervening in risks cannot be understated, the current study suggests that assessing and/or bolstering student strengths can play a significant and positive role in development. This is especially significant given that other tiered frameworks do not account for student strengths in their models and therefore may be missing a critical mechanism towards positive change.

Research aim one

The first aim of the current study was to describe any variability in tier ratings and tier change over time. In terms of tier ratings at each of the five timepoints, students were least commonly given a Tier 3 rating, which is reserved for the students who experience the greatest number of risk factors. This is consistent with previous City Connects studies, as well as with the origins of public health tiered tools that suggest the minority of the population are typically designated as Tier 3, or highest at risk (Frieden, 2010; Gordon, 1983; Marx et al.,

1998; O'Connell et al., 2009). While Tier 1, which reflects the lowest number of risk factors, was the most common tier rating assignment at times one and two of the study, Tier 2a was most common at times three, four, and five. Tier 2b and 3 remained the least common tier ratings throughout the five studied time points.

Despite the higher risk status of the current sample, Tier 3 remained the least common tier rating. These findings reinforce the relativity of tier ratings. In other words, tier differentiates the strength/risk level of students within a classroom in contrast to the broader population. The lowest proportion of students in Tier 3 likely also reflects that, despite the higher risk status of the sample overall, there are still many students who do well due to personal and community strengths that promote thriving despite risks. This strength, inherent in any child or community, can often be overlooked or muted by labeling a community as "high risk" due to poverty status.

Descriptive analyses found that individual student tier rating assignment did change between each time point. For over half of students, tier rating changed each year, and tier ratings changed for each student in approximately half of the year-to-year transitions while the students remained in the study. This amount of change indicates that tier change is relatively common. In terms of "intensity" of tier change, that is, number of levels of change, it was most common for students to change tier rating by one (increase tier of risk by one or decrease tier of risk by one) but a students did also exhibit changes of +/-2 and +/-3 tiers of risk. Changing three tier ratings between two time points was the least commonly observed number of levels of change. This is understandable given that change

over the course of one year, especially within an ISS intervention that is closely monitoring, and trying to promot,e student progress while preventing risk factors from further developing, is likely to be gradual.

Developmental considerations. The sample was limited to elementary school students who were in either kindergarten or first grade at baseline in order to account for some common developmental stages that could partially explain the change in risk over time. While the specific developmental time period was not a core focus of the study nor can be verified by the data, it is still important to consider the various milestones associated with early and middle childhood years as an additional lens through which to understand the variability in tier change indicated by the current results.

Significant physical, mental and social-emotional development occurs throughout elementary school. Social-emotionally, students begin to cooperate with others, are increasingly independent, and have increasingly imaginative play. In terms of academic skills, students begin to identify colors and numbers, can identify similarities and differences, and can adhere to routines. Physically, students develop significant fine and gross motor skills (Centers for Disease Control and Prevention (CDC), 2021). By the end of elementary school, children begin to have stronger and more complex peer relationships, begin to better consider alternate point of views, have an increasing attention span, have significantly better developed fine and gross motor skills and coordination, and some students may even have a significant growth spurt or begin puberty (CDC, 2021). It is clear that significant development occurs during elementary schools

and even within the range of "normative development", children may progress at varying rates. This could potentially contribute to some of the variability in tier rating assignments and changes observed in the current sample.

These milestones cannot be considered independent of the plasticity of developmental trajectories explicated in theory and research. Context has been shown to be highly impactful in shaping the course of developmental trajectories. One of the most powerful negative contexts has been shown to be poverty. The risk factors associated with poverty are amplified for Children of Color due to their experiences of systemic inequality and racism (Alegria et al., 2015; Berliner, 2009; Coleman, 1966; O'Connell et al., 2009; Roy & Raver, 2014). The impacts of poverty are also critically shaped by a variety of personal, relational and contextual strengths (Cichetti, 2006; Masten & Tellegen, 2012; Center on the Developing Child, 2016; Sameroff 1993; 2006; 2009). For example, in the current study, two children might be subject to the same community violence but for one, consistent support and close relationships with friends and family in the home and community contexts might minimize the child's experience of this violence and they may meet all developmental milestones on time. Meanwhile a child without these relational supports who has a biological predisposition for anxiety might go on to develop an anxiety disorder or symptoms of ADHD that critically impact their ability to create friendships or to learn. As these examples portray, the context of poverty and a diversity of strengths and risks likely contribute both to the "consistent" patterns or "profiles" as well as to the variability observed in tier ratings, number of tier changes, and tier change intensity.

In sum, while there is research to suggest that age plays an important role in defining developmental stage, there are a host of other factors at play in addition to age. By keeping age range and school district consistent across time, the current study minimized the variability in development that would be caused by including a wider range of biological ages or geographic areas. These early and middle childhood stages of development should be a narrower lens through which these data are understood. Still, substantial variability in annual tier ratings and tier change was found within the current sample likely due to a host of individual and contextual factors, both related and unrelated to poverty.

Research aim two

The hypotheses associated with research question two were confirmed in part. As predicted, distinct longitudinal Tier Change Profiles did emerge. Hypotheses about students assigned to the low tier/risk ratings would remain at low tier rating assignments were also confirmed. While it was also hypothesized that there would be students who were assigned to high tier/risk ratings that remained with higher tiers/risk ratings over time due to significant and static risk factors that limit the effectiveness of a school-based intervention, this was only confirmed in part. Instead, it was found, that while students who had higher tier rating assignments at baseline did, on average, remain with higher tier/risk ratings over time, there was also significant variability in tier/rating for these students rather than stability. Specifically, the Tier Change Profile identified as Class 3 (high risk, high volatility) was characterized by high tier of risk at each time point and high volatility between all five time points.

Hypotheses that students who were assigned a Tier rating of 2a or 2b would show Tier Change Profiles of decreasing tier/risk and the greatest variability in tier rating assignment were partially supported. Students who received Tier ratings of 2b tended to cluster with students who received ratings of Tier 3 in Class 3 (high risk, high volatility), and showed the same significant variability in tier rating over time. Students assigned a Tier 2a rating at baseline, on the other hand, did not show significant variability in tier rating throughout the entirety of the study. Instead, students assigned a Tier 2a rating showed significant volatility between the first and third timepoints (K-2nd grade/1st-3rd grade) and minimal volatility between third and fifth timepoints (2nd-4th grade/ 3rd-5th grade), and generally students who began in Tier 2a remained in Tier 2a throughout the course of the study. Therefore, students assigned a Tier 2a rating were in a distinct Class from their peers who were assigned to a Tier 2b at baseline.

Hypotheses that there would be a pattern characterized by decreasing tier/risk ratings, were not supported. However, the current study, through its description of Tier Change Profiles, does add nuance to previous research that suggests that students are more likely to decrease in their tier/risk ratings as opposed to increase in their tier ratings within a single year. This can best be understood through identifying the ways in which the observed Tier Change Profiles did and did not demonstrate regression to the mean tier rating. While there was an overall observable regression towards the mean, a common statistical phenomenon, when there are numerical floor and ceilings on discrete variables

(Tier 1 and Tier 3 would be considered the respective floor and ceilings in the current study), the identified Tier Change Profiles illuminate a more complex story. The two tiers that had the greatest opportunity for change (Tier 2a and Tier 2b) showed two significantly different Tier Change Profiles, which landed them in two distinct Classes (Tier 2a was in Class 2, mild risk and early volatility; and Tier 2b was in Class 3, moderate-high risk and high volatility). Further, students assigned a Tier 1 or Tier 3 rating showed different patterns of regression towards the mean. Students with Tier Change Profiles of low risk and high stability showed little variability and little to no change in tier. Meanwhile students with Tier Change Profiles of higher risk and high volatility showed intense and frequent change. These differences in Tier Change Profile of the students who experience the lowest and highest levels/intensity of risks may offer indirect support for previous findings that students who are assigned higher tier/risk ratings are more likely to decrease tier/risk level than students who are assigned lower tier/risk ratings are to increase tier/risk level.

There are likely a combination of factors that explain the Tier Change Profiles that emerged from the current study. These factors cannot begin to be fully explicated by the current study but some theory-driven explanations are offered in the following section based in developmental science and the available descriptive data.

Class 1- low risk/high stability. Firstly, for Class 1, the low risk and high stability Tier Change Profile, students had a minimal number of identified risks at

each of the five time points in addition to strengths which led to their consistent Tier 1 rating assignment.

Cumulative Risk Theory would suggest that the fewer the number of risks a student faces, the less likely it is that student would face negative outcomes (Appleyard et al., 2005; Evans & Whipple, 2013; Rutter, 1979; Sameroff, 2009; Sameroff et al., 1998). Therefore, even at the outset of their developmental trajectories, these students in Class 1 (low risk, high stability) are less likely to experience negative outcomes than their peers who experience a greater number of risk factors and therefore were assigned a higher tier. Further, City Connects refers students to enrichment services across home, school, and community contexts to capitalize on student strengths, buffer against current and future risks, and ultimately, to bolster healthy development. It is well understood that identifying and supporting student strengths can alter the course of development for the better and that this improvement is cumulative and cascading over time (Lewin-Bizan, 2010; Masten & Tellegen, 2012). By doing this in a systematized and coordinated way the positive impacts of intervention are only further enhanced (Adelman & Taylor, 2011; Walsh & Brabeck, 2006). Individual differences and experiences of low risk at baseline coupled with the developmentally grounded intervention approaches likely contributed to the low risk and high stability Tier Change Profile.

Class 3 – high risk/high volatility. Class 3, the Tier Change Profile characterized by high risk and high volatility included the largest proportion of the students in the sample, likely due to the fact that it included two tier rating

assignments at baseline (Tier 2b and 3). It is also possible that the overall high-risk status of the sample led to this most common Tier Change Profile, which was also associated with highest level/intensity of risk.

This Tier Change Profile's (Class 3) composition, though markedly higher in average tier/risk level than Class 1 (low risk, high stability), may be understood through similar theoretical underpinnings as those described for Class 1. Specifically, Cumulative Risk, developmental cascades, and transactional theories of development can help to explain this highest at risk Tier Change Profile. At baseline these students faced a far larger number of risk factors across domains than their peers which thereby increases the possibility that they would experience maladaptive outcomes. Given the holistic way in which City Connects assigns tiers, students who received a Tier 2b or 3 rating assignment were also the most likely to experience significant risks in all developmental domains and across their various contexts. The interactions between these risk factors across domains and between the individual and their environment can lead to compounding impacts of risk, a cycle that becomes increasing difficult in which to make an intervention.

For example, consider a child who exhibits some aggressive behaviors like getting into physical altercations with peers, who is met by inconsistent discipline practices across childcare contexts. This inconsistency may lead to the child's difficulty understanding that aggression is not OK, yielding continued aggressive behavior. If this child also sees physical violence in their community, their behavior may be reinforced as they may feel unsafe and desire to protect

themselves. It may also inhibit their development of behavioral and emotional regulation that would typically occur during elementary school years. Peers and adults may label this child as “defiant” or “bully” which may impact that child’s self-esteem leading them to further withdraw and utilize aggression as they have not been given the opportunity for other ways of expressing anger or fear. This experience would then limit the child’s development of peer interaction skills, another key developmental milestone. If this child has experienced physical trauma of their own, there is an even further layer of risk and complexity. While this child undoubtedly has many strengths, as this example demonstrates, their risks become layered and complex in a way that may overshadow their strengths and necessitates immediate and ongoing intervention on many fronts. Through this example, it becomes clear that while it may be overly simplistic to say that there is a greater chance for these negative outcomes when a child faces multiple and variable risks, the contextual and transactional components of risk that may make for a higher risk or more volatile Tier Change Profile become increasingly clear.

For students at highest risk, the City Connects intervention refers students to intensive and/or crisis intervention services that are individualized as well as to enrichment services to capitalize upon their strengths. If a student responds well to this tailored intervention plan, their risk may decrease in response. Still, this Tier Change Profile’s overall trend of remaining at higher tier/risk rating assignments can be explained by the nature of the poverty-associated risks (e.g., parent unemployment, community violence). These poverty-associated risks that

students experience likely remain unaffected by the intervention leading to their, on average, remaining at a higher holistic tier of risk ratings. This would be consistent with previous literature that shows no evidence of risk level, itself, changing as a result of intervention. The only intervention that has demonstrated change to risk are out-of-school anti-poverty programs which have shown decreases to cumulative risk levels for children and families (Gassman-Pines & Yoshikawa, 2006). City Connects is a holistic intervention but not a direct anti-poverty intervention, potentially explaining why many students who are assigned high tiers of risk generally remain with these high tier of risk ratings over time.

Further, given that City Connects tiers are relative, improvement may not be adequately captured by tier ratings. Students who have been assigned a Tier 1 rating largely remained with that Tier 1 rating and students who have been assigned a higher tier/risk rating assignment are assessed in relation to these peers. Therefore, students assigned a Tier 3 rating who experience a decrease in number of risks or intensity of risks, may not have experienced a substantial enough decrease to "catch up" to the peer group to which they are being compared.

Class 2 – mild risk/early volatility. Class 2, the mild risk and early volatility/later stability Tier Change Profile was comprised mostly of students who remained with Tier 2a ratings over time and presents a more complicated to interpret Tier Change Profile. Tier 2a is assigned to students who exhibit strengths and mild risks. These students are most likely to receive early-intervention and prevention services in addition to the enrichment services that all students receive

regardless of tier rating assignment. Students who are assigned a Tier 2a rating are likely to have mild needs or needs that are emerging (e.g., attentional issues that could potentially put them at risk for ADHD if they worsen). While cumulative risk and transactional theories of development may also be helpful towards understanding why these students remain at relatively low tiers of risk, the role of early intervention should also be considered for these students given its well-established positive impact (National Prevention Council, 2011). For students whose strengths/risks are assigned a Tier 2a rating, risk factors are less compounded or universal than students assigned Tier 2b and 3 ratings, likely increasing the chance for intervention success. Developmental stage is also pertinent for this study, as early intervention literature shows that intervention and prevention is most effective during early years such as those studied in the current sample (National Prevention Council, 2011).

The reasoning for the early volatility exhibited by Class 2 is somewhat difficult to explain using the current data. The transition to elementary school may be one potential explanation for the early volatility in tier ratings. It can take varying lengths of time for students to adjust to higher levels of academic and social expectation in the elementary school context as students enter into elementary school with very different childcare backgrounds. Childcare prior to kindergarten can range from highly structured to highly unstructured as well as with differing levels of peer socialization (Pianta & Cox, 1999). Structure in childcare prior to kindergarten has also been shown to be impacted by socioeconomic status such that wealthier families can afford highly structured

early childcare programs leading to easier transition to elementary school. Students with more unstructured early childcare experiences may have a more difficult transition into elementary school than their peers. Therefore, these students may require a few years of adjustment leading to this early demonstrated volatility in tier rating assignment. Further, development may be fairly undifferentiated in kindergarten and first grade, leading to a need for further maturation in order to distinguish between a delay in development that falls within the range of "normal" (CDC, 2021). These early developmental factors may help to explain the two years of volatility in Tier Change Profiles. Thereafter, the consistent assessment, coordination, and follow-up practices of City Connects may help to stabilize Tier Change Profiles.

Descriptions of each Tier Change Profile. When each of the three Tier Change Profiles were characterized by demographic and educational background variables, there were some notable trends in this descriptive data.

Tier Change Profile trends by demographic and educational factors. In general, the proportion of male students, Black students, students who qualified for special education, and students who qualified for free/reduced lunch, increased from Class 1 to Class 3 (as risk and volatility also increased). In contrast, proportions of White and Asian students were fewer in Class 3 as compared to Class 1. These findings are consistent with previous studies showing that free/reduced lunch, a marker of poverty, is associated with increased instability and unpredictability and therefore higher tier ratings and higher volatility (Berliner, 2009). Special education status has also commonly been found to be a

predictor of increased risk for both maladaptive academic and social-emotional outcomes (Nolan et al., 2013; U.S. Department of Education, 2009). Finally, male gender has been linked to greater risk for school dropout and maladaptive social-emotional outcomes in previous literature and is similarly linked with increasing risk in the current study. Research shows that this may be exacerbated for Men of Color due to experiences of racism and bias from educators and community members (Finn & Rock, 1997).

Independent of gender, findings of increasing proportions of Black students, but decreasing proportions of White and Asian students, exhibiting Tier Change Profiles associated with higher tier ratings of risk and high volatility are also consistent with literature that shows that, largely due to systemic inequality and experiences of oppression, Black students are at greater risk for school dropout and other maladaptive outcomes than their peers (Noguera, 2003). Asian and White students, however, are less likely to be linked with these school-based differences than their Latinx and Black peers (Smith & Reeves, 2020). Interestingly, no trends were evident for the proportion of Latinx students who exhibited the three different Tier Change Profiles. The proportion of Latinx students exhibiting each Tier Change Profile remained around 73%. As a reminder, the majority of students in the current sample (>70%) identified as Latinx. It is possible that having a majority of Latinx students provides a sense of community that can buffer against the impacts of oppression at a local level, an assumption that is consistent with literature that shows the positive impact of community (Maurizi et al., 2013). However, it is also possible the large sample

size of Latinx students and small samples of each of the other groups may statistically amplify the changes for groups with smaller samples while muting changes in the larger Latinx sample.

In terms of school mobility and grade repetition, there was a pattern of increased rates of mobility and grade repetition for Tier Change Profiles associated with higher risk and volatility. This finding is also consistent with literature that shows that consistency and predictability in contexts are key in development and can help students be successful both at home and in school (CDC, 2021). For students that repeated a grade, it is likely that academic or physical milestones were not met putting them at greater risk for academic failure.

Tier Change Profile trends by services and strengths and needs. In terms of services, Tier Change Profiles associated with higher risk had the largest proportion of students who received a higher total number of services. This is consistent with previous City Connects reports that show that students who are assigned higher tier/risk ratings receive a higher number of services than students who are assigned lower tiers/risk ratings. There was only one instance of deviation from this trend in which students in Class 2, the mild risk early volatility Class, received the highest average number of services in the family domain, followed by Class 3 (high risk, high volatility) and Class 1 (low risk, high stability) respectively. Given that this difference was very small (0.03), it is unlikely this is a meaningful trend. In general, City Connects responds to increasing level of need with increasing service provision (City Connects, 2018).

This is consistent with Class 3 receiving the greatest number of services as well as having the highest proportion of students with significant needs (Tier 3).

Patterns of strengths and needs across Tier Change Profiles/Classes were also consistent with these service-related findings in that students in Class 1 (low risk, high stability) had the largest average number of identified strengths with a decreasing average number of strengths for Tier Change Profiles associated with increasing levels of risk. This was consistent for strengths across all academic, social-emotional, health, and family domains. In parallel, students in Class 1 had the least average number of needs across domains while Class 3 had the greatest number of average needs across domains.

While the resulting service trends largely align with previous studies on City Connects tier that suggest tier ratings are correlated with services such that students who experience higher levels/intensity of risk receive the largest number of services, the current study adds an additional correlate with tier. Trends in the results indicate that students who are assigned higher tier/risk ratings also have the highest level of identified needs. These findings add to the validity of City Connects tier, showing its alignment with conceptually related indicators.

Research aim three

While research question two analyses indicated some trends in demographic, educational, service and strength and need variables that corresponded with each Tier Change Profile/Class, research aim three sought to identify whether there was a predictive relationship or significant association

between these variables and Tier Change Profile with a central focus on social-emotional factors.

Background variables as predictors of Tier Change Profile. In terms of demographic variables, it was found that students who received free and reduced lunch status at least once during the study were around 3.6 times as likely to be in Class 3, the high risk and high volatility Tier Change Profile/Class, than Class 1, the low risk and high stability Tier Change Profile/Class. Receiving any of the four possible special education statuses at least at one time point in the study increased the likelihood of being in Class 2 (mild risk, early volatility) as opposed to Class 1 (low risk, high stability), and being in Class 3 (high risk, high volatility) as opposed to Class 1 (low risk, high stability). It is very consistent with the literature that both free and reduced lunch status, a proxy for poverty status, and special education status would be predictive of higher and more pervasive risk groups (Berliner, 2009; Brooks-Gunn & Duncan, 1997; Coleman, 1966; Evans & English, 2002; Freudenberg, 2000; Gershoff et al., 2003; Kiser, 2009; Roy & Raver, 2014).

Findings showed that repeating a grade was a predictor of belonging to Tier Change Profiles of higher risk and higher volatility. This finding is also consistent with previous literature. While repeating a grade can be fairly common in early elementary school years, it is often caused by academic and physical delays, and can lead to increased chances of social isolation or decreased self-esteem. In the long term, repeating a grade has been associated with school

dropout, especially when examined in inner-city and high-poverty contexts (Roderick, 1994).

In terms of special education status predicting Tier Change Profiles characterized by increasing risk and volatility, in order to receive a special education designation in the current study, a student had to qualify for an Individualized Education Plan (IEP) which is put into place for three years, and often renewed after it expires (U.S. Department of Education, 2019). Therefore, special education status becomes somewhat of a static and stable risk factor that likely would not change for three years even in place of the City Connects intervention. To illustrate this by using an example, a student who is diagnosed with autism, may make progress towards their IEP goals, but would still continue to experience greater risk due to this diagnosed difference and this would likely be captured each school year during the WCR process leading to an assignment of a higher tier of risk. This does not necessarily mean that a student is not making adequate progress or experiencing positive development, but rather, that the nature of a special education designation inherently places student at higher and more stable identifiable risk.

In addition to demographic variables, it was found that being in 1st grade at baseline predicted being in Class 2 (mild risk, early volatility) as opposed to Class 1(low risk, high stability) but did not predict being in Class 3 (high risk, high volatility) as opposed to Class 1 (low risk, high stability). There is no clear explanation for this finding. If these results are meaningful, one possible hypothesis could be that, in kindergarten, when a child is new to a school, they

either have no known significant risks or, alternatively, more of a "wait and see" approach is taken to intervention given potentially limited documentation and limited interactions with caregivers at this early stage. This could help to explain why there are a majority of kindergarteners in Class 1 (63.2%), and in Class 3 (53.3%) but not in Class 2 (49.9%).

Strengths and needs as predictors of Tier Change Profile. Hypotheses regarding social-emotional strengths and needs predicted that having a larger number of social-emotional needs would be predictive of stable or decreasing tier ratings over time, and that the same would be true of social-emotional needs. This was in part confirmed in that having a larger average number of social-emotional strengths than social-emotional needs was significantly predictive of low risk and high stability Tier Change profiles as opposed to mild risk/early volatility or high risk/high volatility Tier Change Profiles. The same findings resulted for students with a higher number of average academic strengths than academic needs but not for strengths and needs in the family or health domains. This is consistent with the inherent difficulty in identifying and addressing health and family needs in a school setting.

It is particularly notable that having more strengths than needs was significantly predictive of Class membership while having more needs than strengths was not. While developmental theories are robust in their linking strengths with trajectories and outcomes, quantifying strengths alongside risks has not been previously done in the context of an ISS. The current results can be understood in light of studies of risk and protective factors that suggest strengths

positively impact developmental trajectories in substantive and cumulative ways (Cichetti, 2006; Lewin-Bizan et al., 2010; Masten & Tellegen, 2012).

Additionally, it is possible that the Whole Class Review's (WCR) requiring documentation of strengths in addition to risks could lead to an increase in strengths-based perspectives as opposed to deficit perspectives. Studies show that deficit perspectives can pigeon hole students or lead to a bias in how staff treat students who experience significant needs (Zakaria et al., 2016). The current results align with practice and theory that suggest that identifying strengths in conjunction with needs/risks and doing so across domains benefits students in meaningful ways.

Service association with Tier Change Profile. Hypotheses about social-emotional services predicted that having a larger number of social-emotional services would be associated with stable or decreasing Tier Change Profiles. The results for chi-square analyses were inconclusive towards confirming or rejecting these hypotheses. Overall, patterns suggested that students who received higher tier ratings of risk received more social-emotional services which would be expected given the greater level of need in higher tiers of risk.

However, there were some unexpected patterns of association between Tier Change Profile and services. While students in Class 2 (mild risk, early volatility) received an average of 4 or more services less frequently than expected, this was not the case for students in lower tiers of risk (Class 1). Meanwhile, students in Class 1 did not receive the lowest average number of services more frequently than expected despite having the lowest level of need. A data-based

conclusion cannot be drawn about this finding. It could be that there is a more even distribution of social-emotional services across all Tier Change Profiles which led to the non-significant association between number of services and Tier Change Profiles.

One possible explanation for this seemingly more even service distribution is that prevention and enrichment services are aimed at capitalizing on strengths so they wouldn't necessarily correspond with tier/risk level, but rather would be delivered to all students regardless of tier/risk level. Therefore, it is possible that there was an even distribution of social-emotional prevention and enrichment services regardless of tier rating. This could be caused by a large number of available social-emotional prevention and enrichment services such that students in all tiers were able to access these services at relatively equal rates. This cannot be verified with the available data which included the total number of services by domain but did not differentiate between enrichment, prevention, and intervention services by domain. It's possible that using an average and static service variable blurred the nuance needed to understand the association between services and Tier Change Profiles.

Academic services, on the other hand, were associated with Tier Change Profiles in a more predictable way such that students who received lower tiers of risk who exhibited stable tier ratings over time received the fewest number of services and students who received the highest tier of risk rating exhibited the most volatile tier ratings over time received the greatest number of services. This adds a layer of further nuance to previous City Connects studies that show that

numbers of services is correlated with tier rating such that higher tiers of risk are associated with higher numbers of services. The current study builds upon this finding for academic services showing that services is not only positively correlated with tier/risk level but also with tier volatility such that number of services increase as both tier of risk and volatility of tier change increase (City Connects, 2010; 2012; 2014; 2018).

Interpretation of non-significant family/health findings. While previous interventions and their associated intervention tools considered a focus on academic and social-emotional needs to be "whole child", City Connects also incorporates family and health domains, accounting for a more well-rounded in and out-of-school understanding of each and every child.

Family and health services and strengths/needs profiles were not found to be associated with Tier Change Profiles despite the developmental science that indicates these to be important domains in development. This study's research aims and hypotheses addressed the fact that family and health strengths/needs are more difficult to assess and address in a school context. There is an additional challenge towards assessing and addressing needs in family and health domains in the early elementary school years when a child and their caregiver(s) are less known to school staff.

Overall, academic and social-emotional factors are more visible in school settings. Many times, they can even be assessed through observation and without parent input whereas family and health needs are often assessed through parent input or previous school documentation which is limited in early years. Parent

input can also be limited in a community where the majority of families are socioeconomically disadvantaged. Socioeconomic disadvantage increases the likelihood that parents experience additional barriers to school involvement (language, inconsistent work schedules, etc.) (Lee & Bowen, 2006).

Still, City Connects provides referral to home and community-based services that likely meet family and health needs to an extent that is not common for other school-based interventions and is reflected in trends in the data of increasing services and level of need in family and health domains as tier of risk increases. It cannot be understated that these domains are intrinsically intertwined with academic and social-emotional domains such that any results identified for the latter may not have been found if family and health domains were not addressed.

Implications for Practice

Most notably, this study shows that tier ratings can be characterized into interpretable patterns about student strengths and risks over time (Tier Change Profiles). Further, given that City Connects tier is holistic, and the City Connects intervention is based in developmental science, Tier Change Profiles are interpretable in light of developmental theories. A particularly interesting finding is that having a larger number of social-emotional strengths than needs predicted exhibiting Tier Change Profiles of lower risk and higher stability. Many current tiered intervention frameworks approach the social-emotional domain through a behavioral and deficits-focus. These findings suggest that these approaches miss an opportunity for positively impacting students by acknowledging and enriching

their strengths as well as defining social-emotional foci in a more holistic way than just behavior. It is unclear from the current results whether solely focusing on behavior, even if strengths were considered, would have the same impact on Tier Change Profiles as the impact of social-emotional strengths in the current study. It is also unclear whether focusing on social-emotional and academic factors exclusive of family and health would yield positive or significant results.

Regardless of whether a tiered intervention framework is in place, the current study supports a strengths-based and holistic approach to assessing and working with youth that might account for a student's unique strengths/risk ratio as opposed to looking at risks in isolation or even as opposed to simply looking at number of strengths and number of risks in isolation without comparing these numbers. As risks increase, it may be even more important to build strengths in order to increase capacity for resilience.

In terms of its utility for City Connects researchers and practitioners, the current study has some implications for tier measurement. First, it illuminates the correlations between tier ratings and other intervention variables offering potential indicators for further reliability and validity of tier. For example, as Tier Change Profiles/Classes represented increasing levels of tier/risk and increasing volatility in tier change, average number of needs and average number of services also increased. This positive correlation further substantiates that tier rating is capturing what it aims to capture with increasing tier rating/risk level corresponding with increasing need via multiple indicators. More broadly, the illumination of existing overlaps and consistencies in intervention

measures/indicators also helps illuminate the coordination within the City Connects intervention.

This study also provides some practical considerations towards understanding the ways in which different tier ratings are similar and different. For example, students assigned to Tier ratings 2b and 3 tended to exhibit similar Tier Change Profiles (Class 3 – high risk/high volatility). If this result were replicated, it has implications for measurement refinement. Perhaps, for example, there could be an argument for students assigned Tiers 2b and 3 ratings to be in a combined tier group, or, alternatively, that their paths would be further differentiated if studied with a larger sample or over a longer time period.

In sum, tiered intervention tools have been implemented frequently in public health and educational spheres. While widely accepted as helpful tools for classifying intensity of services and intervening upon varying risk, they have rarely been holistic in nature, and have never been studied at the student level or in a longitudinal manner. This is understandable given that the goal of these tiered intervention tools is to promote positive outcomes which are most directly demonstrated through other measures (e.g., grades). However, in instances when tiered intervention tools are applied to the same population in a routine way, there may be an opportunity to understand trajectories of strengths and risks over time.

Limitations

There were a few central limitations with respect to the variables of interest. Both service and strength and needs variables were recoded into categorical variables in order to assure their fit and interpretability with the

current methods. These recoded aggregated categories reduce the level of nuance in results. This lack of nuance was compounded by the static nature of these variables which were averaged across time points in order to maximize sample size and fit with analyses. Therefore, time-specific data was not accounted for. Additionally, while both service and strengths and needs variables were included for each of the four domains, there was no available data on which services were categorized as enrichment services versus prevention/intervention services versus crisis services for each of the four domains. It is possible that the ratio of enrichment to prevention to intervention to crisis services would further elucidate Tier Change Profiles. Finally, the number of strengths and needs was calculated by applying a count function to Coordinators' text entries using delimiters as separators of distinct entries. Therefore, the qualitative value of each strength and need (e.g., "student has two close friends" vs "student gets along well with all peers") was reduced to equal value regardless of the intensity of the statements.

Sample size due to attrition was also a central limitation in the current study. In order to keep as many contextual factors consistent as possible, the sample was selected from one district, and inclusion criteria required students to be in the same general developmental stage. While the sample was maximized by allowing students to be in kindergarten or first grade at baseline, including multiple cohorts, allowing students to move to different City Connects schools within the district during the study's timeframe, and allowing all students who had three or more years of data to be included, there was still a significant attrition rate.

While approximately 80-98% of students remained at times two through four, a majority of the sample (60%) dropped out between time points four and five which may have limited further differentiation of Classes by tier ratings and tier change at these time points. High levels of attrition is common in longitudinal studies especially those that focus on higher risk populations who are often more difficult to retain at follow up time points (Gustavson et al., 2012; Hafstad et al., 2013). While this does pose a limitation to the current study, numerous measures were taken to limit the impact of missing data on results. Specifically, the RMLCA method used is robust in the face of missing data. Further, in acknowledgement of likely higher error rates due to modal assignment and attrition, analyses used a conservative p-value of 0.01 to determine significance. Further, baseline comparisons did not show significant differences on variables of interest between students who remained in the intervention and those that did not, a finding that would suggest that outcomes are meaningful despite missing data and attrition (Gustavson et al., 2012). Finally, static variables were used in chi-square and regression analyses, computed by averaging across years a student was included in the sample to maximize sample size for the current analyses. While static variables have their limitations in that they do not capture time-specific information that could account for tier ratings or tier change, they did allow for maximization of the sample and contribute to the "big picture" approach of the current study.

Another limitation of the proposed study is the potential clustering of students within schools that is unaccounted for in the current analyses. While City

Connects Coordinators implement a standardized WCR process across schools as evidenced by studies that show high fidelity of WCR practice across Coordinators, it is possible that there are school-level effects that would be better assessed by a multi-level model. The study's sample was taken from a district that only began implementing City Connects one year prior to the study's baseline year. Given the variation in when implementation began and the relatively high rates of attrition of students, there were some included schools that had less than 15 students in the current sample. If multi-level models were used with this small sample, there likely would have been biased estimates of standard errors that would only further complicate the current results and was therefore impractical for the current study (Maas & Hox, 2005). Still, it is recommended that a multi-level approach be taken in the future to assure that clustering of students within schools, and within Coordinators, is accounted for within explanatory models of holistic tiering and tier change.

Most broadly, there is a central limitation of generalizability of the current findings. Firstly, the current study is exploratory and should be replicated in order to assert generalizability. Secondly, the majority of the sample identified as Latinx which presents the issue of sampling bias and limits generalizability of findings to other "high risk", inner-city, and underserved populations which include a diverse array of races and ethnicities. Still, while not representative of the general U.S. population, the demographic makeup of the sample closely aligns with the population of interest for the current study – urban, low-income, Students of Color, who have been historically more at risk for school failure and thus have

been targeted by many ISS interventions like City Connects. The high-risk nature of the current sample is further illuminated by the difference between the included sample and students who were also in kindergarten or first grade at baseline but did not remain in the intervention long enough to be included in the sample. The included students were demographically higher risk than the excluded sample. It is incredibly important that we understand the particular trajectories of students in this highest at-risk category, and just as important to acknowledge the many strengths and the variability amongst this group of students that is often lumped together in the literature and very rarely defined or recognized by their strengths.

Future directions

The future directions that emerge from the current study center on three central themes which include (1) validating the current findings through increasing and expanding the sample, (2) extending the current findings through utilization of increasingly complex methods, and (3) using Tier Change Profiles to assess whether City Connects tier might mediate any academic and behavioral outcomes.

To validate these preliminary results that tiered intervention tools can be studied over time and that tier rating assignments do create meaningful patterns over time, additional studies should be conducted to see whether the current findings are replicated. Studies with larger samples and lower attrition may potentially find an increased number of Classes or differently defined Classes that differentiate between students who increase tier and students who decrease tier. City Connects researchers might also choose to conduct these replication studies

across multiple districts, adding a clustering variable into the model to account for any variation between districts, and potentially even between schools if the sample is large enough. It may also be important to conduct smaller, case study analyses, to better understand the individual-level factors that influence Tier Change Profiles.

Utilizing specific developmental timeframes in the current study had its benefits. There were very few markers of development in the data, apart from whether a student was retained in the same grade, making it difficult to account for the variance in tier due to various developmental milestones. Therefore, keeping students in the same general developmental stage allowed for some consistency in developmental milestones. Once these results are replicated using the same developmental timeframe, it would also be interesting to conduct a study that expands the inclusion criteria, allowing for a variety of developmental timeframes and increasing number of years. Validating with the same developmental period as well as including additional time points or distinct timeframes could further illuminate the intersection between developmental, strengths and risks, and intervention factors. Including a larger number of years may also further differentiate the resulting Tier Change Profiles.

In the current study, covariates were explored via regression analyses and were not included in the RMLCA model building phase due to the increasingly complex interpretation of resulting Classes as covariates are added into the model. After the current findings are validated, covariates could be included in the model-building phase in order to better understand the time-specific impacts of

services and strengths and needs on tier ratings and tier change. This would also present the opportunity to distinguish between the different effects of strengths and needs. For example, rather than simply entering the number of strengths and needs, if the strengths and needs text entries were coded, it may be found that personal risk factors or strengths (e.g., attention) might be more predictive of a low risk and high stability Tier Change Profile than contextual strengths or risks (e.g., poverty status). Another possible level of complexity would be allowing for interaction effects in the regression models to help to define the combination of background or intervention-related variables that may lead a student to belong to each of the identified Tier Change Profiles. For example, one possibility could be that being in special education and being female might be less predictive of Tier Change Profiles characterized by higher risk than being in special education and being male.

Finally, while the short- and long-term outcomes of City Connects are positive, well-established, and consistent across districts, the current study did not include these outcomes. Therefore, it is unclear whether students, regardless of the Tier Change Profile they exhibited, were generally improving academically and social-emotionally. It has been demonstrated that the longer a student remains in the City Connects intervention the more positive their experienced impacts. Therefore, it is likely that students included in the current study generally improved academically and behaviorally though this can't be verified. A future study that includes Tier Change Profile as a predictor and/or mediator of academic and social-emotional outcomes could help to elucidate whether any

relationship between Tier Change Profiles and outcomes exists. If it is found that students experience positive impacts of the intervention regardless of Tier Change Profile, these results could provide additional support for findings that show City Connects has positive impacts on students living in poverty. Alternatively, it could be found that City Connects outcomes moderate student tier change such that students who experience positive impacts of the intervention are more likely to experience decreases or stable risk. Regardless of how it is studied, an understanding of the relationship between Tier Change Profiles and City Connects outcomes could elucidate an important link between research on risk and resilience, intervention, and school-based outcomes

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