

Instability vs. quality: Residential mobility, neighborhood poverty, and children's self-regulation

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**Abstract**

Prior research has found that higher residential mobility is associated with increased risk for children's academic and behavioral difficulty. In contrast, evaluations of experimental housing mobility interventions have shown moving from high poverty to low poverty neighborhoods to be beneficial for children's outcomes. This study merges these disparate bodies of work by considering how poverty levels in origin and destination neighborhoods moderate the influence of residential mobility on 5<sup>th</sup> graders' self-regulation. While previously unexamined, prior work suggests that residential mobility may be particularly salient in the development of children's self-regulatory skills with potential consequences for behavioral adjustment and early learning. Using inverse probability weighting with propensity scores to minimize observable selection bias, this work finds that experiencing a move during early or middle childhood is related to negative child outcomes (as indicated by increased behavioral and cognitive dysregulation), measured via direct assessment and teacher-report, in 5<sup>th</sup> grade. Moreover, these relationships are moderated by neighborhood poverty, with moves out of low poverty and moves into high poverty neighborhoods being particularly detrimental.

Keywords: residential mobility, self-regulation, neighborhood poverty, inverse probability weighting

## Residential mobility and children's self-regulation

Residential mobility (defined as moving from one home to another) in childhood has been linked with adverse educational (Astone & McLanahan, 1994; Pribesh & Downey, 1999; Wood, Halfon, Scarlata, Newacheck, & Nessim, 1993) and behavioral adjustment outcomes (Adam & Chase-Lansdale, 2002; Hendershott, 1989; Simpson & Fowler, 1994), particularly among low-income samples. Various mediating mechanisms have been proposed to explain these relationships, including the disruptive nature of moving, the loss of familiar environments and social connections, the breakdown of stable routines, and the anxiety and stress caused by the move itself (Adam, 2004; Oishi & Talhelm, 2012). Although moving households may produce instability and stress, a change in residence may also be accompanied by a shift in neighborhood economic conditions. This second dimension of moving, whether to a more economically distressed or advantaged neighborhood, may make a significant difference in the meaning and impact of the move for children's well-being. For example, data from housing policy interventions have demonstrated that moves from high-poverty to low-poverty neighborhoods are linked to benefits in terms of children's behavior problems (Johnson, Ladd, & Ludwig, 2002; Katz, Kling, & Liebman, 2001) and academic outcomes (Rosenbaum, 1991; 1995).

The following paper tests the role of housing mobility in the development of children's self-regulatory skills among a sample of 385 low-income children living in urban neighborhoods. We examine the influence of both moves themselves and the moderating role of poverty rates in origin and destination neighborhoods as a way to reconcile the contradictory nature of past findings. In particular, we hypothesize that the instability of moving may negatively affect children's self-regulation skills, which have, in turn, been argued to undergird children's behavioral adjustment and early learning (Blair & Razza, 2007; Raver, Blair, & Willoughby,

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2013). In keeping with this hypothesis, emerging research has shown low-income preschool-aged children's early experiences of household instability to be linked to reductions in their ability to delay gratification, pay attention, and control impulsivity (McCoy & Raver, 2013). In addition, recent work has highlighted the role of highly stressful social contexts such as neighborhoods and schools for children's self-regulatory skills (Evans & English, 2002; McCoy, Raver, & Sharkey, 2013; Raver et al., 2013) This growing body of work suggests that children's ability to self-regulate may be affected not only by residential mobility itself, but also by the associated shifts in the quality of children's neighborhood environments, over time.

Drawing on longitudinal data from a socioemotional intervention trial implemented in Head Start pre-school programs, we use families' address data to determine whether children experienced a residential move across any of the four waves of data collection. Address data were geocoded and linked with census data in order to explore the economic context (% population in poverty) of origin and destination neighborhoods. After employing inverse probability weighting with propensity scores to minimize observable selection bias associated with families' likelihood of moving, this study examines 1) whether exposure to a move during early or middle childhood is related to changes in micro- and macro- dimensions of children's self-regulation in 5<sup>th</sup> grade and 2) whether the economic quality (high versus low poverty) of the neighborhood of origin or destination moderates this relationship. In this way, we unite disparate literatures on the effects of mobility and neighborhood quality by considering how both the absolute experience of moving and the quality of the move are related to the development of children's self-regulatory skills.

## **Residential Mobility and Children's Development**

Residential mobility has been conceptualized and operationalized in a variety of different ways, including frequency of moves, distance moved, reason for shift, attributes of neighborhood moved to or from, and time since residential change (Jelleyman & Spencer, 2008). However, perhaps the most commonly employed definition is a measure of the number of moves that occurred during a given time period. In general, researchers examining this dimension of residential mobility have found detriments to children's educational, behavioral, and adjustment outcomes among low-income families that move relative to those who do not (Adam, 2004; Adam & Chase-Lansdale, 2002; Astone & McLanahan, 1994; Leventhal & Newman, 2010; Pribesh & Downey, 1999; Stoneman, Brody, Churchill, & Winn, 1999; Wood et al., 1993). Although prior work has examined the role of residential mobility in children's development using both cross-sectional and longitudinal data, the majority of this work has focused on short-term relationships, particularly in terms of social and emotional outcomes (Hango, 2006; Leventhal & Newman, 2010). As a result, questions remain about how a move experienced in childhood may influence children's social-emotional development in the long-term.

Many researchers have highlighted the disruptive nature of moving as the underlying factor driving its detrimental influence on children. Specifically, the interference with activities and routines, the loss of familiar places and networks, and decreases in parents' well-being and parenting quality have all been cited as potential mediating pathways (Adam, 2004). These changes can be accompanied or exacerbated by psychological reactions such as excitement, anxiety, and anticipated loneliness (Oishi & Talhelm, 2012). In line with this conceptualization, Pribesh & Downey (1999) found that a loss in social capital (defined as students' and parents' connections to school and community) partially explained the relationship between residential

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mobility and adolescent academic achievement. The decision to move does not occur in isolation, but rather often happens in response to parental transitions that can be positive (e.g., employment at a better paying job) or negative (e.g., divorce) for children in the long-term (McLanahan, 1983; McLanahan & Sandefur, 1994; South, Crowder, & Trent, 1998). Although such transitions may affect children's functioning in and of themselves, it has been argued that the instability and stress of a residential move may have an influence on children above and beyond strains associated with precursors to the move (Adam & Chase-Lansdale, 2002).

### **Changes in Neighborhood Poverty**

Although residential moves can be accompanied by disruption, instability, and stress, they also have the potential to shift the quality of a family's neighborhood of residence. Decades of research have established that residence in economically disadvantaged neighborhoods is related to detriments in children's functioning across socio-emotional, behavioral, and cognitive domains (Brooks-Gunn, Duncan, & Aber, 1997; Leventhal & Brooks-Gunn, 2000). Moreover, findings from two of the most well-studied mobility interventions, the Gautreaux Project and Moving to Opportunity, provide some support for the theory that relocation to lower poverty neighborhoods is beneficial for children and families. In the Gautreaux Project, children in families who moved out of highly segregated Chicago neighborhoods into more racially and economically diverse suburban neighborhoods had higher rates of high school completion, college attendance, and labor force participation in early adulthood than children who remained within the city (Kaufman & Rosenbaum, 1992; Rubinowitz & Rosenbaum, 2000). In Moving to Opportunity, families who received housing vouchers were living in safer, lower poverty neighborhoods than families who did not four to seven years after random assignment (Kling, Liebman, & Katz, 2007). Voucher receipt was also associated with beneficial effects for

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children's physical and mental health, education, and risky behaviors, although these benefits were seen primarily for girls. Moreover, moving from a high-poverty to a lower-poverty neighborhood was associated with long-term (10- to 15-year) improvements in adult physical and mental health and subjective well-being (Ludwig et al., 2012).

Although findings from mobility programs provide understanding about how shifts in neighborhood quality may matter for children's development, they fail to consider how the intersection between residential mobility and neighborhood quality may influence individuals. However, some work suggests that considering mobility in the context of the quality of the move is important (Hango, 2006; O'Brien, Gallup, & Wilson, 2012). For example, among a sample of adolescents living in Chicago, Sharkey & Sampson (2010) identified differential trajectories of violence among children who moved within the city and those who moved outside of the city; moves within the city were associated with an increased risk of violence (both in terms of exposure to and perpetration), whereas moves outside of the city were associated with reductions in exposure to violence and violent offending. Moreover, the difference in outcomes was explained by differences in the racial and economic composition of destination neighborhoods, variation in school quality, and adolescents' perceived control over their new environment.

### **Instability, Neighborhood, and Self-Regulation**

Although prior research has established relationships between residential mobility and children's cognitive and behavioral outcomes, less is known about the developmental processes that may underlie those associations. The theoretical framework of experiential canalization may be particularly helpful in this regard, as it emphasizes ways that cumulative exposures to multiple forms of environmental adversity may alter or disrupt children's stress physiology and corresponding neurocognitive and behavioral functioning, over time (see Blair & Raver, 2012 for

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more detail). Specifically, cumulative exposure to harsh, unpredictable environments (where stressors are outside the individual's control) leads to disruptions in parasympathetic function (e.g., the HPA-axis, as indicated by blunted diurnal patterns of cortisol output), which in turn affect synaptic activity in the prefrontal cortex and higher-order cognitive processing, or executive function (Badanes, Watamura, & Hankin, 2011; Blair, 2010; Blair, Granger, & Razza, 2005; Miller, Chen, & Zhou, 2007). Recent studies have yielded clear evidence in support of this theoretical framework; preschoolers living in poverty are almost five times as likely to demonstrate disrupted patterns of diurnal cortisol as their non-poor counterparts (Zalewski et al., 2012), and increased exposure to economic hardship is associated with significantly lower levels of cognitive self-regulation (Blair & Raver, 2012; Noble, McCandliss, & Farah, 2007; Raver et al., 2013; Raver, McCoy, Lowenstein, & Pess, 2013; Zalewski et al., 2012). Moreover, children's exposure to additional family and neighborhood stressors (e.g., high levels of household instability, neighborhood crime) also has direct effects on their self-regulatory outcomes (Lengua, Honorado, & Bush, 2007; McCoy & Raver, 2013; McCoy et al., 2013). Although these past studies provide promising preliminary evidence that poverty-related stressors within the contexts of home and neighborhood have important implications for low-income children's development of self-regulation, few studies have focused on residential mobility, in particular. In addition, past research on instability and self-regulation has focused on short time periods (i.e., one year or less), and has not necessarily taken into account the precursors or consequences of these changes in the context of children's neighborhood quality, over longer periods of time.

In the following paper, we explore this important and understudied question regarding the linkage between residential mobility and children's self-regulation from early through middle



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childhood. In so doing, we consider self-regulation along both cognitive and behavioral dimensions, focusing on the “volitional” aspects of self-control for the purposes of “goal-directed action” (Blair & Ursache, 2011). We operationalize this definition of self-regulation using multiple forms of assessment across multiple time points, including more fine-grained, microanalytic measures of children's accuracy and latency to respond on specific lab-based tasks and at a more molar level through adults' reports of children's observable regulatory behaviors. This dual approach allows for a more empirically conservative test of the role of mobility between “baseline” and follow-up time points as a predictor of children's *gains* in micro-level, higher-order cognitive aspects of self-regulation, as well as in more global measures of behavioral and cognitive control as captured by adult reports.

### **The Issue of Selection in Residential Mobility**

Perhaps the most commonly cited concern in studies of residential mobility and neighborhood change is the issue of selection, where decisions around moving are non-random and driven by a wide range of economic factors, psychosocial stressors, and family circumstances. For example, many family moves result from job loss, loss of income, or a change in parents' marital status (e.g., divorce or remarriage; Ackerman, Kogos, Youngstrom, Schoff, & Izard, 1999; Astone & McLanahan, 1994; Böheim & Taylor, 2002; Speare & Goldscheider, 1987). The resulting empirical challenge is that those same factors have also been established as detrimental to children's developmental outcomes, and therefore may represent significant threats to the ability to draw inferences regarding the role of mobility, *per se*, on child self-regulation. Although previous work has addressed this issue by adjusting models for family demographic characteristics (e.g., Adam & Chase-Lansdale, 2002; Astone & McLanahan, 1994), this approach does not eliminate concerns about selection bias. In the present paper, we employ

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inverse probability weighting (IPW) using propensity scores as a more stringent approach to minimizing the observable selection bias associated with mobility and more accurately estimate the influence of moving itself (Imbens, 2004; Kurth et al., 2006; Robins, 1999; Rosenbaum, 1987; Sato & Matsuyama, 2003). Conceptually equivalent to propensity score matching, IPW uses propensity scores to reweight the treatment group (in this case, families who move) and the control group (non-movers) to be more similar to one another across measured demographic, economic, and social risk characteristics. Although the use of IPW does not rule out the possibility of bias on variables that are not included in the model, it does eliminate selection bias on included variables, therefore strengthening causal claims.

### **The Present Study**

The present study aims to address several gaps in the literature. First, by exploring the direct relationship between the experience of residential mobility over the course of six years and low-income children's gains in self-regulatory functioning in elementary school, this work considers the potential long-term consequences of mobility on the previously unstudied outcome of self-regulation. In addition, by utilizing two different measures that capture both micro- and macro-level manifestations of self-regulation in both preschool and late elementary school, we are able to better identify the strength of the influence of residential mobility on children's cognitive and behavioral self-regulation over time. Finally, by examining the joint influence of residential mobility and the economic quality of origin and destination neighborhoods, this work integrates two previously divergent bodies of work. Although findings from studies of residential mobility have shown moving to be detrimental for children's development, evaluations of mobility interventions have linked moves from high to poverty to low poverty settings to improvements in children's functioning. As such, this work considers whether the quality of the

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move (defined as moves into or out of high poverty neighborhoods) moderates the influence of residential mobility on children's self-regulation.

### **Methods**

#### **Sample**

Data for this study come from the Chicago School Readiness Project (CSRP), a longitudinal follow-up of a socioemotional intervention trial implemented in preschool programs located in high-poverty Chicago neighborhoods. At baseline, 602 participants were recruited in two cohorts from 35 Head Start classrooms and randomly assigned to either intervention or control conditions. At baseline, caregivers were an average of 29.53 years old ( $SD = 7.66$ ). The majority of caregivers identified as African-American (70%) or Latino (26%), while a small proportion identified as non-Hispanic White (4%). On average, the children in the sample were 49.16 ( $SD = 7.38$ ) months old and there were slightly more girls (53%) than boys. The average income-to-needs ratio for the sample was 0.67 ( $SD = 0.59$ ), indicating that the majority of children came from households whose income and family size placed them below the national poverty line.

#### **Procedure and Measures**

In the fall of the pre-school year, children's self-regulatory skills were assessed via direct assessments and assessor report by a group of master's level assessors who had received extensive training and certification in assessment administration. At the 5<sup>th</sup> grade follow-up, children's self-regulation was again assessed with a battery of computerized direct assessments administered during the regular school day. Children's caregivers completed a set of questionnaires that included demographic and household information, either in person or by phone, at each wave of data collection. Finally, also as a part of the 5<sup>th</sup> grade follow-up, children's teachers reported on individual children's behavior.

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**Residential mobility.** Household addresses reported by caregivers at each wave of data collection were used to calculate residential mobility. A change in address across any two subsequent waves was coded as a move (1) and no change was coded as stable (0). In instances where information was missing at one wave but available at the preceding and subsequent waves, this information was used to infer the missing wave. For example, if a family had an address at wave 1, was missing address data at wave 2 but had the same original address at wave 3, wave 2 was coded as stable. If families had ever moved across any wave, they received a 1 on our measure of residential mobility; non-movers received a 0.

**Neighborhood poverty.** Families' addresses at each wave were geocoded using ArcGIS software (version 10; ESRI, 2011). For the purposes of these analyses we use census block groups as our operationalization of neighborhood boundaries. Census block groups are the smallest unit of geography for which census data are available and as such are likely to reflect the smaller boundaries that individuals use to define their neighborhoods (Coulton, Jennings, & Chan, 2013). Estimates of the percentage of the block group population living in poverty were obtained from the American Community Survey 2006-2010. Measures of neighborhood poverty at baseline and 5<sup>th</sup> grade are used in these analyses.

**Child self-regulation.** At baseline, child self-regulation was measured using a combination of self-regulatory tasks and independent assessor ratings of children's self-regulation during assessment. The self-regulatory tasks included two direct assessments of executive function from the Preschool Self-Regulation Assessment (PSRA), a comprehensive 30-minute battery capturing children's self-regulation and cognitive skills (Smith-Donald, Raver, Hayes, & Richardson, 2007). Children completed the Balance Beam and Pencil Tap tasks, both of which examined children's attention to assessor instructions, working memory of the rules,

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and inhibition of impulsive responses. For the Balance Beam task, children were asked to walk as slowly as possible along a piece of tape on the floor after waiting for the assessor's instructions to begin. For the Pencil Tap task (an adapted version of Luria's 1966 classic "peg-tapping" task), children were asked to tap a pencil on a desk once when the assessor tapped her pencil twice, and to tap the pencil twice when the assessor tapped once. Tasks were scored based on children's performance (e.g., ability to follow directions) and time to completion.

Following the assessment, each assessor completed the 28-item PSRA Assessor Report for each child. The PSRA Assessor Report captures children's attention, behavior, and emotion during the tasks using a scale of 0 to 3. For the present set of analyses, only items capturing children's attention/impulse control (e.g., concentration, distractability, impulsivity, and regulation of arousal) were used. The overall internal consistency for the attention/impulse control factor was high at  $\alpha=.92$ . To reduce collinearity in study analyses, scores on the Pencil Tap task, the Balance Beam task, and the attention/impulse control factor of the PSRA assessor report were standardized (i.e., z-scored) and averaged to represent children's baseline self-regulatory skills.

At the 5<sup>th</sup> grade follow-up two dimensions of self-regulation were measured. The first of these was executive function, conceptualized as a micro-level cognitive dimension of self-regulation encompassing three skills: working memory, inhibitory control, and attention set shifting (Diamond & Lee, 2011). Executive function was assessed using the computerized Hearts and Flowers task (Davidson, Amso, Anderson, & Diamond, 2006). In this task participants completed a set of 57 trials. Prior to beginning the task participants were instructed to place their left index finger on a key of the left side of the keyboard and their right index finger on a key on the right side of the keyboard. In the first block of 12 trials, a heart appeared on either the right or

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left side of the computer screen and participants were instructed to press the button that was on the *same* side as the heart. In the second block of 12 trials, a flower appeared on either the right or left side of the screen and participants were instructed to press the button on the *opposite* of the screen as the flower. In the final block of 33 trials, incongruent and congruent trials were intermixed and participants were asked to apply the appropriate rule to each display, therefore requiring participants to remember the rules, inhibit the incorrect response, and shift attention between trial types. Stimuli were presented for 2000ms with an interstimulus interval of 1000ms. Mean response latencies were calculated by averaging the latency to respond across all trials of a given block. Trials were excluded from aggregates if the response was incorrect or if the response latency was less than 200ms indicating that participants could not have consciously seen the stimulus. In our analyses, the outcome of interest is mean response latency on the mixed trials given that these trials tap the three dimensions of executive functioning. All analyses include mean latency on hearts only trials in order to adjust models for speed of processing and better isolate executive functioning. Lower mean latency indicates higher executive functioning.

The second representation of self-regulation included a global measure of cognitive and behavioral self-regulation that was rated by children's classroom teachers at the 5<sup>th</sup> grade follow up. A composite of two measures, the Barratt Impulsiveness Scale, Version 11 (BIS-11; Patton, Stanford, & Barratt, 1995) and the Behavior Rating Inventory of Executive Function (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000), was used to assess children's self-regulatory skills. This approach has been shown to be reliable and valid in samples of low-income, ethnic minority school-aged children (McCoy, Raver, Lowenstein, & Tirado-Strayer, 2011). The full scale used in these analyses consists of 27 items ( $\alpha = .97$ ) that tap dimensions of cognitive (e.g. "Has short attention span") and behavioral dysregulation (e.g. "Interrupts others"). All items were

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standardized on a 0 to 1 scale before scale creation. The BIS-BRIEF scale used in analyses was multiplied by 100 to avoid small coefficients.

**Covariates.** Caregiver-reported demographic and household characteristics collected at baseline were used for estimating propensity scores to be used in inverse probability weighting and included in regression models to increase the precision of the estimates. These variables included demographic information (cohort; treatment group; child age and gender; caregiver age and race/ethnicity), economic characteristics (education, hours worked per week, receipt of public assistance, current assets, family income-to-needs ratio), and dimensions of household (in)stability (having a partner, household size, numbers of moves in the previous year – self-report). Family's income-to-needs ratio was calculated based on yearly earnings and family size (U.S. Bureau of the Census, 2012).

### **Analytic Plan**

Propensity scores were calculated conditional on a set of baseline covariates including child self-regulation, demographic, economic, household, and neighborhood characteristics. Covariates were selected based on prior work and theory demonstrating relationships with both residential mobility and self-regulation (Jelleyman & Spencer, 2008; McCoy & Raver, 2013; Raver et al., 2013). We defined propensity scores as the probability that families would move between baseline (preschool) and 5<sup>th</sup> grade as a function of included baseline covariates. Because the samples with valid data on the two outcomes measures varied slightly (Hearts and Flowers N = 314; BIS-BRIEF N = 350; valid data on both Hearts and Flowers and BIS-BRIEF N = 279) and we wanted to use as much available data as possible, propensity scores were created separately for the two samples using the same set of baseline covariates.

We control for propensity scores in the final regression equation using inverse probability weighting to estimate the average treatment effect. In particular, all movers received a weight

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equal to their estimated propensity score ( $p$ ), and non-movers received a weight equal to the inverse of their estimated propensity score ( $1/p$ ). By re-weighting movers and non-movers to be more similar to one another (i.e., an “average treatment effect” approach), the full sample of participants can be included in the final set of analyses. Assuming that a comprehensive set of covariates is used and all assumptions are met, the use of inverse probability weighting with propensity scores allows us to make inferences about the effect of a moving versus not moving on children's self-regulation.

Propensity scores were estimated using `psmatch2` in Stata 12 (Leuven & Sianesi, 2003). Interaction terms and transformed covariates were added to the model to increase the specification of the estimates. Final models were selected based on the balance of the means and standard deviations of each covariate. Prior to weighting, movers and non-movers differed significantly ( $p < .10$ ) on eight of the 19 covariates in the Hearts and Flowers sample and 6 of the covariates in the BIS-BRIEF sample. Once weighted there were no statistically significant differences at  $\alpha = .10$  between movers and non-movers in either sample. In order to further assess balance, standardized difference in means (the differences in means divided by the pooled standard deviation) and ratios of the standard deviations were examined. After weighting, the average standardized difference in means among the Hearts and Flowers sample was reduced from .18 to .05. In addition, the ratio of the standard deviations was evaluated by assessing the average deviation from the optimum ratio of 1.00 in the unweighted and weighted samples. This value was reduced from .08 to .04 upon weighting. Similar reductions were seen in the BIS-BRIEF sample; the average standardized difference in means was reduced from .17 to .06 and the average deviation in the *SD* ratio was reduced from .07 to .05 upon weighting. While the bias for both means and standard deviations were greatly reduced after weighting, slight differences



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between movers and non-movers do remain. Therefore, final regression models include all baseline covariates to further increase the precision of the estimates and reduce potential bias (Mincy, Hill, & Sinkewicz, 2009).

Prior work has shown that combination of propensity score weighting and regression can be more effective at reducing bias than either method in isolation (Rubin, 1979; Rubin & Thomas, 2000). Therefore, to estimate the relationship between residential mobility and children's self-regulation skills we ran separate OLS regression models, including probability weights, in which having ever moved and the full set of baseline covariates (including self-regulation) were used to predict each of the measures of self-regulation. To test the moderating influence of neighborhood poverty in origin and destination neighborhoods on self-regulation, measures of neighborhood poverty at baseline and 5<sup>th</sup> grade and their interactions with residential mobility were added to the model. Indicators of poverty in origin (i.e., baseline) and destination (i.e., 5<sup>th</sup> grade) neighborhoods were included simultaneously in order to avoid multiple comparisons, though results were consistent when origin and destination interactions were tested independently.

### **Missing data**

Among the two samples with valid outcome data, no cases were missing information on residential mobility. However, there was a modest amount of missing data across baseline covariates. In both the Hearts and Flowers and BIS-BRIEF samples data were missing on nine of the 19 baseline covariates. Missingness ranged from a low of 2% for hours worked to a high of 16% on children's baseline self-regulation. To capitalize on all available data, missing values for each covariate were imputed using the average of the non-missing values for each corresponding variable. Given the relatively small amount of missing data, mean imputation was decided to be

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an appropriate approach. In addition, a binary variable representing missing data on any covariate (along with a binary variable indicating whether the family was missing move data at any wave) was included in the estimation of propensity scores (Haviland, Nagin, & Rosenbaum, 2007). Modeling missingness in predicting propensity scores lessens some of the imprecision of simple mean imputation and increases the likelihood that bias associated with missingness is equally distributed across matched groups.

### **Clustering of Data**

Given our interest in the role of neighborhood influences on children's self-regulation, it is important to consider whether the clustering of families within neighborhoods may bias our estimates. The clustering of families within neighborhoods in our sample is small; the 385 children with valid outcome data on either measure are nested within 218 neighborhoods at baseline (children per neighborhood,  $m = 1.70$ ,  $SD = 1.23$ ) and 271 neighborhoods in 5<sup>th</sup> grade (children per neighborhood,  $m = 1.40$ ,  $SD = .89$ ). In order to determine the amount of variation in outcomes that exists between neighborhoods, interclass correlations (ICCs) were calculated at preschool and 5<sup>th</sup> grade for both outcomes. All ICCs were small ( $< .05$ ), indicating that less than 5% of the variation in the outcomes is between neighborhoods. As a result, the decision was made not to run the analysis as a multi-level model or to cluster standard errors. However, the "robust" option in Stata was used to estimate standard errors using the Huber-White sandwich estimators in order to take into account issues concerning heterogeneity and lack of normality.

## **Results**

### **Descriptive Statistics**

The majority of families (72%) moved at least once over the course of the study. Of those that moved, 56% moved once, 33% moved twice, and 11% moved 3 times. In addition, families

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were more likely to move when children were older, with 15% of the sample moving between preschool and kindergarten, 42% of the sample moving between kindergarten and 3<sup>rd</sup> grade, and 57% of the sample moving between 3<sup>rd</sup> grade and 5<sup>th</sup> grade. All of the families were living within the city boundaries of Chicago at baseline and the vast majority (92%) of the study sample remained in Chicago at 5<sup>th</sup> grade. On average, families moved into slightly lower poverty neighborhoods over the course of the study: baseline neighborhood poverty ( $m = 30.39$ ,  $SD = 16.62$ ), and 5<sup>th</sup> grade neighborhood poverty ( $m = 28.21$ ,  $SD = 16.96$ ). In order to get a better understanding of the types of moves families made, neighborhood poverty at wave 1 and wave 4 were each recoded into three categories: low poverty neighborhoods (0% - 19.99%), moderate poverty neighborhoods (20% - 30%), and high poverty neighborhoods (30.01% and above). A neighborhood shift variable was then created for movers ( $N=277$ ) to represent change in neighborhood quality across waves (Table 1). While 41% of the sample made a lateral move (moving into neighborhoods with a similar poverty level), 24% of the sample experienced a decline in neighborhood quality (moving into neighborhoods with higher poverty levels) and 35% of the sample experienced a neighborhood improvement (moving into neighborhoods with lower poverty levels).

Movers and non-movers differed on several demographic and economic characteristics. In the Hearts and Flowers sample ( $N=314$ ), OLS and logistic regression models, in which each of the covariates was regressed on residential mobility, revealed differences on eight of the covariates. Children in families that moved were less likely to be in cohort one ( $b = -.66$ ,  $SE = .06$ ,  $p = .02$ ), more likely to be in the treatment condition ( $b = .43$ ,  $SE = .25$ ,  $p = .08$ ), more likely to be African American ( $b = .77$ ,  $SE = .26$ ,  $p < .01$ ), and less likely to be Latino ( $b = -.71$ ,  $SE = .27$ ,  $p < .01$ ) than children in families that did not move. Caregivers in families that moved were younger ( $b =$

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-3.07,  $SE=.93$ ,  $p<.01$ ) and less likely to have a partner ( $b=-.71$ ,  $SE=.25$ ,  $p<.00$ ) than caregivers in families that did not move. Households that moved had lower income-to-needs ratios ( $b=-.13$ ,  $SE=.07$ ,  $p=.05$ ) and had more moves in year before baseline ( $b=.14$ ,  $SE=.06$ ,  $p=.02$ ) than households that did not move. A similar pattern emerged in the BIS-BRIEF sample: cohort ( $b=-.69$ ,  $SE=.24$ ,  $p<.01$ ), African American ( $b=.92$ ,  $SE=.25$ ,  $p<.01$ ), Latino ( $b=-.81$ ,  $SE=.27$ ,  $p<.01$ ), caregiver age ( $b=-2.99$ ,  $SE=.86$ ,  $p<.01$ ), partner ( $b=-.57$ ,  $SE=.24$ ,  $p=.02$ ), and income-to-needs ( $b=-.13$ ,  $SE=.07$ ,  $p=.06$ ).

### **Residential Mobility and Self-Regulation**

To test whether mobility was predictive of children's self-regulation, we ran two OLS regressions with analytic weights in which each measure of children's self-regulation was regressed on residential mobility and the full set of covariates. Results revealed that children who experienced a move have slower response latencies (indicating greater dysregulation) on the Hearts and Flowers task than children who did not move ( $b=36.20$ ,  $SE=16.84$ ,  $p=.03$ ), with movers responding 36.20 ms (or 0.22 standard deviations) slower on the task relative to those children who did not move (Table 4, Model 1). Similarly, teachers reported greater dysregulation on the BIS-BRIEF among children who moved relative to those who did not ( $b = 6.04$ ,  $SE=3.04$ ,  $p=.05$ ); children who moved were scored as being 6.04 points (or 0.24 standard deviations) higher in dysregulation than non-movers (Table 4, Model 3).

### **Neighborhood Poverty as a Moderator**

In order to examine whether poverty in origin and destination neighborhoods moderate the relationship between residential mobility and children's self-regulation, neighborhood poverty in baseline and 5<sup>th</sup> grade and their interactions with residential mobility were added to the models. The interaction between residential mobility and baseline neighborhood poverty was

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significantly related to children's Hearts and Flowers performance ( $b=-10.65$ ,  $SE=5.11$ ,  $p=.04$ ; Table 4, Model 2). In addition, the interactions between residential mobility and baseline neighborhood poverty ( $b=-1.57$ ,  $SE=.61$ ,  $p=.01$ ) and residential mobility and 5<sup>th</sup> grade neighborhood poverty ( $b=1.72$ ,  $SE=.58$ ,  $p<.01$ ) were significantly related to children's BIS-BRIEF ratings. To examine the nature of these relationships, the interactions were graphed (Figures 1-3) and simple slopes were tested to determine if they were different from 0. Moving out of a low poverty neighborhood was associated with a 189ms (or a 1.17 standard deviation) increase in response time on the Hearts and Flowers task (A to B slope;  $t(288)=2.59$ ,  $p=.01$ ). In contrast, the shape of the interaction suggests that moving out of a high poverty neighborhood is related to reductions in response time on the Hearts and Flowers task; however, this simple slope was only marginally statistically significant, most likely a result of the large standard error (C to D slope;  $t(288)=-1.86$ ,  $p=.06$ ). Similarly, moving of a low poverty neighborhood was associated with a 27.38 (or a 1.08 standard deviation) increase in teacher-reported dysregulation (A to B slope;  $t(326)=3.10$ ,  $p<.01$ ), whereas moving out of a high poverty neighborhood was related to a 24.47 (or 0.98 standard deviation) *decrease* in teacher-reported dysregulation (C to D slope;  $t(326)=-2.02$ ,  $p=.04$ ). In comparison, moving into a low poverty neighborhood by 5<sup>th</sup> grade was associated with a 27.91 (or a 1.12 standard deviation) decrease in teacher-reported dysregulation (A to B slope;  $t(326)=-2.34$ ,  $p=.02$ ), whereas moving into a high poverty neighborhood by 5<sup>th</sup> grade was associated with a 30.82 (or a 1.24 standard deviation) increase in teacher-reported dysregulation (C to D slope;  $t(326)=3.53$ ,  $p<.01$ ).

## Discussion

Findings from the current study parallel past work demonstrating that residential mobility has negative consequences for low-income children's development. Specifically, when

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controlling for baseline self-regulatory skills and using inverse probability weighting as a rigorous estimation strategy, we find that exposure to a move across early and middle childhood is related to determinants in children's self-regulation in 5<sup>th</sup> grade. Children who experienced a move had slower response times on the Hearts and Flowers assessment, indicating lower micro-level executive function, compared to their non-mobile peers. These findings were robust when adult reports of children's self-regulation were considered as the dependent variable: Children who moved were reported to have more difficulty with regulating attention, cognition and behavior in a classroom setting (as reported by teachers) than were non-movers, even after taking into account children's initial levels of self-regulation in early childhood. These findings support previous hypotheses that instability and disruption (e.g., loss of familiar environments and routines, loss of social connections) may underlie the influence of residential mobility on children's development (Adam, 2004). Placing these findings within the theoretical frame of experiential canalization (Blair & Raver, 2012), this work suggests that early exposure to residential mobility and the accompanying experiences of instability and disruption may lead to biological changes in both parasympathetic (adrenocortical) and neurocognitive response among children exposed to early stressors (Blair & Raver, 2012; Davies, Sturge-Apple, & Cicchetti, 2011), adaptations which may manifest in observable differences in children's cognitive and behavioral regulatory skills.

Although we found an overall detrimental effect of residential mobility on children's self-regulation, we also found that rates of poverty in origin and destination neighborhoods moderated these relationships. Specifically, the interaction between residential mobility and neighborhood poverty in preschool significantly predicted children's performance on the Hearts and Flowers task and teachers' BIS-BRIEF ratings after adjusting for children's self-regulation at

## Residential mobility and children's self-regulation

baseline and neighborhood poverty in 5<sup>th</sup> grade. Testing of the simple slopes revealed that children who moved out of low poverty neighborhoods had worse performance on the Hearts and Flowers task and higher teacher-reported dysregulation in 5<sup>th</sup> grade than children who remained stable in low poverty neighborhoods. In addition, children who moved out of high poverty neighborhoods had lower teacher-reported dysregulation than children who remained stable in high poverty neighborhoods.

Importantly, we were also able to examine the role of neighborhood quality for families' "destination" neighborhoods. We found that the relationship between residential mobility and teachers' reports of children's dysregulation was moderated by levels of neighborhood poverty experienced by families in 5<sup>th</sup> grade, even after adjusting for neighborhood poverty and children's self-regulatory skills in preschool. Tests of the simple slopes revealed that children who moved and ended up in low poverty neighborhoods by 5<sup>th</sup> grade had lower teacher-reported dysregulation than children who remained stable in low poverty neighborhoods. In contrast, children who moved and ended up in high poverty neighborhoods by 5<sup>th</sup> grade had higher teacher-reported dysregulation than children who remained stable in high poverty neighborhoods. One explanation for these findings may be that residential moves that take children out of higher quality neighborhoods or place them in lower quality neighborhoods may exacerbate the negative influence of mobility by either compounding disruption (through exposure to "cumulative" risks) or making adaptation to a new environment more difficult. Our findings also suggest that families' decisions to move children out of high poverty neighborhoods do not result in these same negative consequences for children's self-regulation; long-term reductions in stress exposure may counteract the short-term disruption of moving. These findings lend empirical support to a key dimension of experiential canalization theory, namely that children's trajectories

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of self-regulation are environmentally modifiable in ways that may alternately reflect “insult” (as illustrated by children's lower regulation in the context of moves to worse neighborhoods) and “repair” (as reflected by moves to better neighborhoods, where the provision of supports and the reduction of risks may also offer points of protection and even remedy; Blair & Raver, 2012).

### **Mobility Patterns and Demographic Differences**

Not surprisingly given prior work linking poverty and mobility, descriptive analysis of our data revealed high levels of residential mobility (72% of families experienced a move during the six-year study period) within our low-income sample. In addition, 44% of movers moved more than one time. An examination of neighborhood poverty shifts revealed significant variation in the types of moves families made: Although many of the movers in our sample made lateral moves (41%) into neighborhoods with similar levels of poverty, 24% moved into higher poverty neighborhoods (experiencing declines in neighborhood quality) and 35% moved into lower poverty neighborhoods (experiencing improvements in neighborhood quality). These results are striking in that they suggest that all moves are not equivalent. Moreover, this finding counters prior assumptions that low-income movers primarily make lateral moves into similar quality neighborhoods (Schafft, 2006).

Our analysis of demographic characteristics for mobile and stable families also revealed notable similarities and differences. Of the 17 characteristics examined, differences were found for seven. Paralleling past findings, families who moved had lower income-to-needs ratios, were more likely to be single, and more likely to have moved in the previous year than families who did not move. Highlighting the relevance of concerns over selection, these differences may reflect motivations for moves. Lower resourced families may be more inclined to move either to pursue economic opportunities or because of financial strains that may lead to eviction.

Similarly, single parents may be more likely to experience a change in partner status, which may



## Residential mobility and children's self-regulation

be accompanied by a move and previously mobile families may be more likely to move again. There were also important similarities across the groups. Although the groups did differ on income-to-needs ratio, they did not differ on other economic-related characteristics such as employment, hours worked, assets, and public assistance. In addition, groups did not differ on rates of neighborhood poverty at baseline. These similarities suggest that economic circumstances are not the sole motivating factor for moves in this low-income sample. Moreover, although the influence of mobility on children's self-regulation is moderated by poverty in origin and destination neighborhoods, it is unlikely that neighborhood poverty is playing a large role in the original decision to move. Although it is clear that family and economic characteristics play an important role in families' decisions to move, these results suggest that additional work is needed to further explore both motivations to move and how families decide where to move, factors that may further elucidate the ways in which residential mobility may influence children's development.

### **Limitations and Future Directions**

Like many studies of its kind, this study has several limitations. First, because we chose to focus on only one dimension of mobility (i.e., whether families ever move across this six-year period) we may be underestimating the influence of mobility on children's self-regulation. Prior work has shown the influence of mobility to be non-linear with a greater number of moves being more strongly related to children's functioning, a theory we could not directly test without significantly revising our modeling strategy. In addition, our operationalization of mobility does not capture the timing nor the psychological controllability of the move. Prior work has shown differential effects of mobility depending on the developmental period in which the move occurs (Haveman, Wolfe, & Spaulding, 1991), and much of the extant work in the role of stress for individuals' allostatic load, reactivity and regulation highlights the importance of considering

## Residential mobility and children's self-regulation

whether stressors are within or outside of the individual's control. In spite of these limitations, we chose to operationalize mobility as we did for two reasons. By considering exposure to any move across this salient six-year period of children's development we are making a conservative estimate of the influence of any residential change on children's self-regulation. In addition, by calculating moves from address data, rather than subjective reports, we can capitalize on census data to assess the quality of origin and destination neighborhoods.

Finally, although this work moves beyond much of the prior research on residential mobility by using inverse probability weighting with propensity scores as a rigorous estimation strategy, selection bias is still a concern given that it is unlikely that our models include all potential confounding variables. Moving forward, researchers need to continue to explore factors that motivate families' decisions to move and capitalize on methodological approaches that are robust to selection bias in order to strengthen causal claims.

Despite these limitations, this work makes several important contributions to the field. First, it demonstrates that experiencing a move between preschool and 5<sup>th</sup> grade is related to overall reductions in children's self-regulation, both in terms of micro-level cognitive regulatory abilities and teachers' reports of macro-level cognitive and behavioral regulatory skills. Although prior work has linked residential mobility to detriments in children's behavioral and academic outcomes, to our knowledge this is the first study to examine relationships with self-regulation skills, which have been shown to play an important role in children's early learning and academic performance. Moreover, this study is one of few to consider how the quality of the move, specifically in terms of poverty in origin and destination neighborhoods, may moderate the relationship between mobility and children's self-regulation. We find that all moves may not affect children equally, with moves that take children out of high quality neighborhoods or place

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them into low quality neighborhoods being the most detrimental. These findings have important implications for housing policy and highlight the importance of examining policy implementation within the frame of contextual quality.

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Table 1. Shifts in neighborhood quality between baseline and 5<sup>th</sup> grade (N=277 movers)

Baseline	5 <sup>th</sup> grade	N	%
<b>Improvement</b>		<b>91</b>	<b>35%</b>
High	Moderate	34	13%
High	Low	34	13%
Moderate	Low	23	8.8%
<b>Lateral</b>		<b>107</b>	<b>41%</b>
Low	Low	26	9.9%
Moderate	Moderate	22	8.4%
High	High	59	22.5%
<b>Decline</b>		<b>64</b>	<b>24%</b>
Low	Moderate	16	6.1%
Low	High	20	7.6%
Moderate	High	28	10.7%

*Note:* Low poverty (0-19.99%), Moderate poverty (20%-30%), High poverty (30.01% and above)

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Table 2. Covariate means and standard deviations for Hearts and Flowers sample before and after weighting (N=314)

	Unweighted				Weighted		Unweighted		Weighted	
	Movers N = 220		Non-Movers N = 94		Non-Movers N = 94		<i>d</i>	Ratio of <i>SDs</i>	<i>d</i>	Ratio of <i>SDs</i>
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>				
Child characteristics										
Self-regulation	.12	.73	.13	.84	.10	.77	.00	.86	.03	.94
Cohort	.50	.50	.66	.48	.54	.50	-.32	1.05	-.09	1.00
Treatment	.56	.50	.45	.50	.56	.50	.22	1.00	-.01	1.00
Boy	.46	.50	.48	.50	.50	.50	-.05	.99	-.10	.99
Age	49.91	7.28	49.41	7.25	49.74	6.78	.07	1.00	.02	1.07
African American	.74	.44	.56	.50	.71	.46	.39	.89	.06	.97
Latino	.22	.41	.36	.48	.25	.43	-.35	.86	-.07	.96
Caregiver characteristics										
Age	28.98	7.54	32.05	7.66	29.45	7.22	-.41	.98	-.06	1.04
Less than high school	.22	.42	.31	.46	.22	.42	-.21	.90	.00	1.00
Weekly hrs worked	21.58	18.06	22.14	20.46	20.03	20.60	-.03	.88	.09	.88
Have partner	.37	.48	.54	.50	.37	.48	-.36	.97	.00	1.00
Household characteristics										
Assets/savings	1.03	.77	1.15	.89	.98	.84	-.15	.87	.06	.92
Total public assistance	2.63	1.59	2.39	1.65	2.76	1.58	.15	.97	-.08	1.01
Income-to-needs	.63	.53	.77	.55	.63	.53	-.25	.96	.01	1.01
Household size	4.42	1.59	4.54	1.73	4.41	1.63	-.08	.92	.01	.97
Moves in previous yr	.30	.48	.17	.39	.22	.50	.29	1.25	.16	.97
Neighborhood poverty	29.44	15.62	29.12	17.99	29.58	17.75	.02	.87	-.01	.88
Missing data indicators										
Missing any move	.06	.24	.06	.25	.08	.27	.00	1.00	-.06	.90
Missing any covariate	.30	.46	.36	.48	.30	.46	-.15	.95	.00	1.00
<i>MEAN<sup>d</sup></i>							.18	.08	.05	.04

t < .10, \* < .05, \*\* < .01 for differences compared to movers, unweighted. There were no differences post-weighting.

<sup>d</sup>Mean *d* is the average of the absolute value of the difference in means divided by the pooled *SD*; Mean Ratio of *SDs* is the average of the absolute value of the ratios' deviation from 1.

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Table 3. Covariate means and standard deviations for BIS-BRIEF sample before and after weighting (N=350)

	Unweighted					Weighted		Unweighted		Weighted	
	Movers N = 251		Non-Movers N = 99			Non-Movers N = 99		<i>d</i>	Ratio of <i>SDs</i>	<i>d</i>	Ratio of <i>SDs</i>
	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>					
Child characteristics											
Self-regulation	.03	.74	.03	.84		-.01	.82	.01	.88	.05	.91
Cohort	.45	.50	.62	.49	**	.53	.50	-.34	1.02	-.16	.99
Treatment	.55	.50	.46	.50		.50	.50	.18	1.00	.09	.99
Boy	.47	.50	.54	.50		.52	.50	-.13	1.00	-.10	1.00
Age	49.21	7.48	48.89	7.34		48.91	7.62	.04	1.02	.04	.98
African American	.78	.41	.59	.50	**	.74	.44	.47	.84	.11	.94
Latino	.18	.38	.32	.47	**	.21	.41	-.39	.81	-.08	.94
Caregiver characteristics											
Age	28.87	7.19	31.86	7.28	**	29.57	7.03	-.42	.99	-.10	1.02
Less than high school	.24	.43	.31	.47		.27	.45	-.16	.92	-.07	.96
Weekly hrs worked	21.19	18.07	21.67	20.71		22.40	21.85	-.01	.87	-.07	.83
Have partner	.38	.48	.52	.50	*	.38	.49	-.29	.97	-.01	1.00
Household characteristics											
Assets/savings	1.02	.78	1.13	.88		1.01	.88	-.14	.89	.02	.89
Total public assistance	2.65	1.64	2.44	1.68		2.71	1.64	.13	.97	-.04	1.00
Income-to-needs	.65	.56	.77	.59	t	.69	.60	-.23	.93	-.09	.92
Household size	4.50	1.59	4.47	1.84		4.49	1.83	.02	.86	.07	.87
Moves in previous yr	.33	.54	.23	.56		.28	.59	.19	.97	.10	.93
Neighborhood poverty	30.35	16.10	30.40	17.53		30.39	16.85	.00	.92	.00	.96
Missing data indicators											
Missing any move	.07	.25	.06	.24		.08	.28	.03	1.05	-.06	.91
Missing any covariate	.29	.46	.33	.47		.29	.46	-.09	.96	.00	1.00
<i>MEAN<sup>d</sup></i>								.17	.07	.06	.05

t < .10, \* < .05, \*\* < .01 for differences compared to movers, unweighted. There were no differences post-weighting.

<sup>d</sup>Mean *d* is the average of the absolute value of the difference in means divided by the pooled *SD*; Mean Ratio of *SDs* is the average of the absolute value of the ratios' deviation from 1.

Residential mobility and children's self-regulation

Table 4. Residential mobility and neighborhood poverty predicting child dysregulation

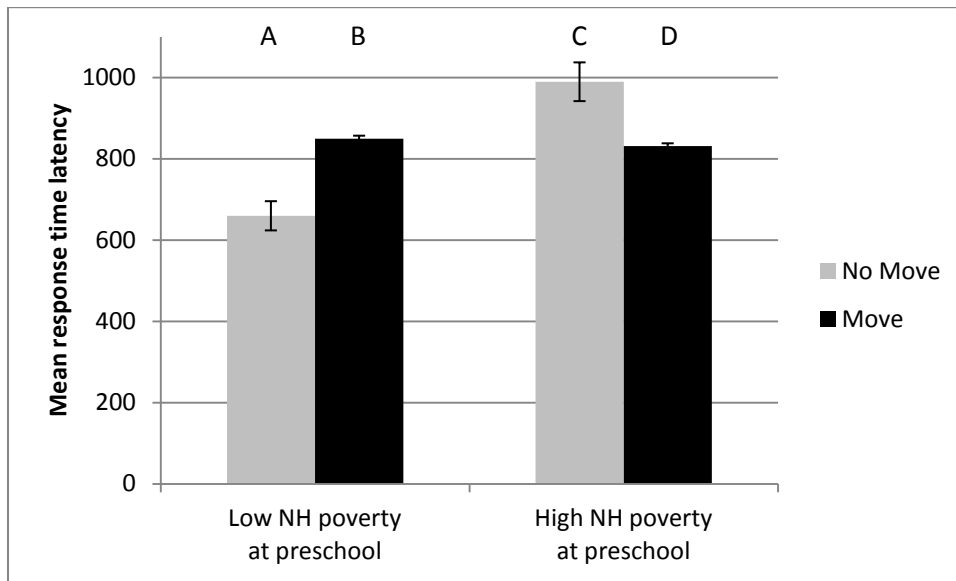
	Hearts and Flowers						BIS-BRIEF					
	Model 1			Model 2			Model 3			Model 4		
	<i>B</i>	<i>SE</i>		<i>B</i>	<i>SE</i>		<i>B</i>	<i>SE</i>		<i>B</i>	<i>SE</i>	
Constant	814.84	41.65	**	832.13	43.14	**	14.95	6.83	*	18.84	7.19	**
Residential mobility (RM)	36.20	16.84	*	15.80	20.40		6.04	3.04	*	1.45	3.49	
Hearts only latency	.88	.14	**	.86	.14	**	-	-		-	-	
Self-regulation	-33.52	13.27	*	-32.82	13.07	*	-2.35	1.92		-3.09	1.94	
Cohort	-17.45	21.17		-10.76	21.06		0.41	3.73		0.76	3.81	
Treatment	6.50	18.50		6.12	18.50		4.72	3.05		4.08	3.09	
Boy	-47.25	18.00	**	-51.47	18.04	**	15.48	2.98	**	14.32	3.01	
Child age	-20.36	11.43	t	-23.80	11.37	*	-4.40	1.89	*	-4.44	1.96	*
African American	-10.34	35.83		-6.81	37.48		4.53	5.00		5.74	5.15	
Latino	-41.11	36.39		-50.18	38.43		-4.37	5.42		-5.21	5.65	
Parent age	-10.94	12.17		-11.57	12.56		-1.74	1.69		-1.95	1.70	
Less than high school	57.45	18.59	**	59.29	19.22	**	1.34	3.57		2.40	3.57	
Weekly hrs worked	3.04	5.89		2.63	5.84		1.13	0.92		1.38	0.93	
Have partner	28.92	18.26		30.87	18.19	t	1.25	3.14		1.31	3.15	
Assets/savings	21.74	11.66	t	20.99	11.87	t	1.99	2.00		1.38	2.02	
Total public assistance	11.34	5.70	*	11.10	5.84	t	0.89	1.19		0.66	1.20	
Income-to-needs	20.57	18.60		24.83	18.35		-8.00	3.13	*	-7.73	3.14	*
Household size	.44	5.93		.28	6.00		-0.63	0.99		-0.76	0.99	
Moves in previous yr	2.96	17.81		3.41	18.04		2.52	2.77		2.19	2.72	
Neighborhood (NH) poverty	4.43	4.68		-	-		-0.77	0.73		-	-	
Missing any move	-42.11	25.17	t	-30.33	24.26		-4.69	4.81		-1.64	4.83	
Missing any covariate	36.20	18.89	t	34.02	18.69	t	-3.37	3.17		-3.05	3.17	
NH poverty at preschool				10.09	5.05	*				1.59	0.58	**
RM by NH poverty at preschool				-10.65	5.11	*				-1.57	0.61	*
NH poverty at 5 <sup>th</sup> grade				-8.89	5.06	t				-1.78	0.56	**
RM by NH poverty at 5 <sup>th</sup> grade				8.70	5.10	t				1.72	0.58	**

t < .10, \* < .05, \*\* < .01



## Residential mobility and children's self-regulation

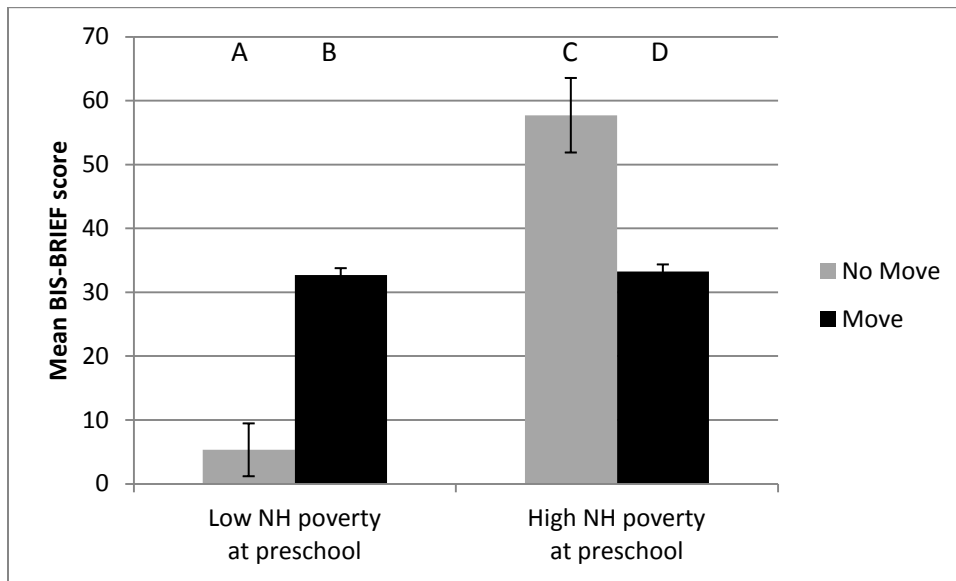
Figure 1. Interaction between residential mobility and neighborhood poverty at preschool predicting Hearts and Flowers response time



*Note:* Error bars represent standard errors

## Residential mobility and children's self-regulation

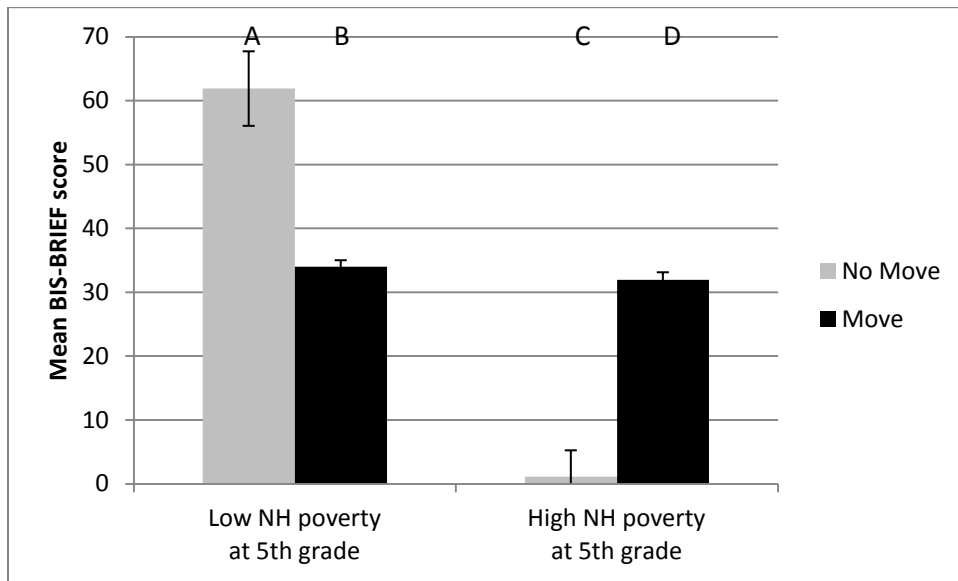
Figure 2. Interaction between residential mobility and neighborhood poverty at preschool predicting teacher-reported BIS-BRIEF score



*Note:* Error bars represent standard errors

## Residential mobility and children's self-regulation

Figure 3. Interaction between residential mobility and neighborhood poverty at 5<sup>th</sup> grade predicting teacher-reported BIS-BRIEF score



Note: Error bars represent standard errors