School Mobility and Educational Success:

A Research Synthesis and Evidence on Prevention

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Abstract. This report assessed the effects of school mobility on achievement and dropout in 16 studies from 1990-2008 that included pre-mobility achievement. 13 of the studies found that mobility from kindergarten to high school was independently associated with outcomes. Findings indicated that children who moved 3 or more times had rates of school dropout that were nearly one-third of a standard deviation higher than those who were school stable net of prior achievement other factors. Frequent mobility was also associated with significantly lower reading and math achievement by up to a third of a standard deviation. In marginal effects, each additional move was associated with a reduction in reading and math achievement of about one-tenth of a standard deviation. Further analysis of one of the included studies--the Chicago Longitudinal Study--that controlled for residential moves and school factors in an urban context revealed that students who move frequently or beyond third grade experience the most detrimental effects. Evidence also is presented that mobility contributes indirectly to school performance and later well-being. The Child-Parent-Center preventive intervention is illustrated to show the benefits of preschool-to-third-grade approaches to reducing the prevalence of mobility.

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It is well-documented that student mobility is associated with lower levels of school achievement and performance, and higher risks for behavioral problems. Because American children experience among the highest rates of mobility, greater understanding is needed about the impact of mobility on school adjustment. In this report, we synthesize research over the past two decades on the effects of the most studied type of mobility–changing schools--on school achievement and dropout. We also summarize evidence about interventions designed to reduce mobility and its negative consequences. Three major questions are addressed:

1. Among well-controlled studies, what is the magnitude of the association between student mobility from kindergarten to high school and achievement and school dropout?
2. Does the estimated link between mobility and school performance vary by the timing and frequency of moves, child and family characteristics, and study characteristics?
3. What interventions have been found to reduce mobility and associated risks?

1. Background and Research Context

1.1. Prevalence of Mobility

The United States has one of the highest rates of residential and school mobility in the industrialized world (Long, 1992). Between 2007 and 2008, 1 in 8 Americans changed residences, which is over 35 million people (U.S. Census Bureau, 2009). While annual mobility rates have typically exceeded 14% over the past two decades (U. S. Census Bureau), cumulative rates over multi-year periods exceed 20%. Among school-age children, 8.8 million or 14% of 5- to 19-year-olds changed residences between 2002 and 2003, the most recent data available (Schachter, 2004).

With roughly two-thirds of residential moves requiring a change of schools, and many other school transfers occurring without residential mobility, the rate of school mobility over a 2- to 3-year period commonly exceeds 30%. The U. S. General Accounting Office (GAO, 1994) reported that 41% of national sample of third graders changed schools between the beginning of first grade and the end of third grade. The National Center for Education Statistics (2001) reported that one third of fourth graders in the National Assessment of Educational Progress changed schools in the previous two years due to a residential move.

1.2. Variability in Mobility Rates

Although mobility rates are relatively high, they vary substantially by economic status, age, family configuration, type and frequency, and social context. In the nationally representative Early Childhood Longitudinal Study, Kindergarten Cohort study (ECLS-K), Lee and Burkam (2002) reported a dose-response relation between children's residential stability and family socioeconomic status (SES). The percentage of children living in only one home in the 5 years since the birth was 50% higher for those in the top SES quintile than in the bottom quintile (42% vs 28%). The discrepancy was 35% between the top and the second lowest quintile. The percentage who lived in 4 or more homes over this period was at least 20% for all SES groups.

Since a majority of residential moves result in school moves, these findings suggest relatively high levels of school changes. Younger children have higher rates of mobility; 21% of 1-4 year-olds change households compared to 14% for 5-9 year-olds, and 13% for 10-19 year-olds (Schachter, 2004).

Mobility also varies by type, frequency, and context. Roughly two-thirds of residential moves are within the same counties while one-third are between counties or from abroad (U. S. Census Bureau). In the GAO (1994) report of the U. S. Department of Education's Prospects study of 15,000 children, 41% of third graders changed schools from beginning of first grade and 17% attended 3 or more schools. While 25% of inner-city third graders changed schools 3 or more times, this was double that of rural and suburban children.

Finally, three cohort studies from the Chicago Public Schools show the consistent and pervasive nature of mobility in urban schools, which serve higher concentrations of low-income and minority children. In a 1985-86 representative sample of over 1,500 children in government-funded kindergartens, Temple and Reynolds (1999) found that 73% of Chicago Longitudinal Study (CLS) participants had one or more non-normative school moves between kindergarten and seventh grade. 43% had 2 or more moves and 21% had at least 3 moves.

In a 1994 stratified random sample of 14,000 Chicago sixth graders, Kerbow (1995) reported that 62% changed schools from first to sixth grades. 36% moved at least once within the past two years and 13% moved 3 or more times (Kerbow, 1996). In survey responses about the reasons for moving, 40% reported school-related reasons (e.g., safety, dissatisfaction) were solely responsible for the most recent move, 28% cited a change of residence, and 30% indicated a combination of residential and school-related circumstances.

Among a complete cohort of Chicago first graders in 2000, Torre and Gwynne (2009) found that only 25% remained in the same school until eighth grade. Cumulative rates of mobility by sixth, seventh, and eighth grades were 66%, 72%, and 75%, respectively. These were roughly double the rates of mobility in high school.

These high mobility rates are found in many other areas. In a low-income New York City school, Heinlein and Shinn (2000) found that over 40% had two or more moves from kindergarten to sixth grade and 25% had at least three moves. Alexander, Entwisle, and Dauber (1996) found in their first-grade Baltimore City sample that 56% changed schools over the next five years and that 43% of those remaining in Baltimore schools transferred to other schools. In Texas public elementary schools, Mao, Whitsett, and Mellor (1997) reported that over 60% of all students changed schools at least once (normative or non-normative) over a four-year period while Hanushek, Kain, and Rivkin (2004) found that over three years about a third of their grade 4 to 7 cohorts had non-normative moves.

1.3. Understanding the Influence of Mobility on Children

Whether residential or school-related, mobility is a classic ecological transition, definable as a change in the setting, role, or expectations of an individual (Bronfenbrenner, 1989). Although such transitions do not invariably compromise child well-being, and may promote better adjustment in some circumstances, mobility in general has long been found to be associated with lower average school achievement (Alexander et al., 1996; Gruman et al., 2008; Ream, 2005), increased risk of school dropout (Ou & Reynolds, 2008; Rumberger & Larson, 1998; South, Haynie, & Bose, 2007), increased need for remedial education (Alexander et al., 1996; Ou & Reynolds, 2008), and social and psychological difficulties (Rumberger, 2003;

Swanson & Schneider, 1999). The association or predictive link is commonly found to occur above and beyond child family background factors (Lee & Burkam, 2002) and to a lesser extent, pre-mobility adjustment (Alexander et al., 1996; Temple & Reynolds, 1999).

School mobility can contribute to low school performance and related difficulties because it introduces discontinuities in learning environments that alter or weaken instructional, school, and peer ecologies. Subject-matter curricula and expectations in the classroom can differ dramatically across schools, which in addition to the process of adjustment itself, can adversely affect learning. This often carries over to learning in the classroom. As noted by Entwisle, Alexander and Olson (1997), teachers in schools serving many high-risk children "find it necessary almost continuously to 'reteach' 'backtrack' or in other ways try to catch new students up to the class" (pp. 77-78). Changing schools also requires adjusting to a new school, new teachers, and new peer groups that may hold different attitudes and expectations about school life which lead to a different school climate than what the student is used to. Without institutional supports to smoothen such transitions, performance deficits may emerge.

Detrimental effects on peer relations are a further potential consequence mobility. Mobile children are more likely than school-stable children to have disruptions in peer relationships that lead not only to weaker peer relationships but lower engagement in the social environments of school and community (Swanson & Schneider, 1999; South et al., 2007). As Coleman (1988) noted in describing his theory of social capital, these lower social ties and school attachments increase the risk of school underachievement. For example, South et al. (2007) found that peer characteristics were stronger mediators of the relation between mobility and school dropout than parent-student relationships or school achievement.

Finally, links between mobility and poorer school performance may be a function of economic disadvantages and stressors within family and neighborhood contexts. Children who move are more likely to be ethnic minorities, reside in low-income and in single-parent households, and have home languages other than English (Alexander et al., 1996; Schachter, 2004). Satisfaction with schools and safety also are lower for mobile children than for school-stable children, especially in urban contexts (Kerbow, 1996; U. S. GAO, 1994). Nevertheless, mobility and frequent mobility in particular, have consistently been found to independently predict child outcomes (Mehana & Reynolds, 2004; Rumberger, 2003).

Given the developmental importance of stability and predictability in learning environments and of children's active participation in them as articulated in social capital (Coleman, 1988), ecological (Bronfenbrenner, 1989), and resilience (Wright & Masten, 2005) theories, the impact of mobility during the formative years, especially if frequent, can be expected to lead to adjustment difficulties.

1.4. Previous Reviews of the Effects of Mobility

Although reviews of the effects of school mobility span more than three decades (Schaller, 1972, 1976; Lacey & Blane, 1979; Jones, 1990; Mehana, 1998; Rumberger, 2002, 2003), in the most recent and only published meta-analysis, Mehana and Reynolds (2004) synthesized 26 studies of the effects of K-to-Grade 6 school mobility on reading and math achievement completed over a 20-year period (1975-1994). The average weighted effect size in standard deviations (Cohen's d) was found to be -0.25 for reading test scores and -0.22 for math test scores (see Table 5, Col. 5). Although these coefficients were statistically reliable, estimates were heterogeneous across studies. Studies assessing frequent (versus less frequent) had effects

sizes of -0.32 and -0.34 for reading and math, respectively, compared to respective effect sizes of -0.21 and -0.18 for the contrast of any mobility versus none.

Mobility during K-4 was associated with larger effect sizes than after Grade 4, especially for math achievement (-0.30 vs. -0.14; reading, -0.26 vs -0.22). For math, low SES and minority children were found to experience more detrimental effects. Notably, these estimated effect sizes were considerably lower than found in the previous unpublished meta-analysis by Jones (1990), who included school-level mobility and a wider methodological range of studies dating to the 1930s.

Although Mehana and Reynolds (2004) assessed the best available research for the years studied, 3 limitations are apparent. First, nearly all of the studies did not control for school achievement or adjustment prior to moving. As has been increasingly documented (Reynolds & Bezruczko, 1993; Rumberger, 2003; Swanson et al.,1998; Temple & Reynolds, 1999), pre-mobility achievement is a strong predictor of mobility and later outcomes. Although review findings are consistent with some studies that control for pre-mobility achievement, inclusion of a larger percentage of well-controlled studies is needed. Moreover, only 5 of the studies in the meta-analysis were published in peer-reviewed journals.

Second, longer-term school success and attainment were not examined in the review, which is of major policy relevance. The extent to which mobility exacts long-term negative effects would provide important information for school administrators and policy makers in reducing the prevalence of mobility. The impact of mobility on school dropout is especially relevant, and some studies indicate mobility is a risk factor (Alexander et al., 1997; Ou & Reynolds, 2008; Rumberger, 2002). However, its status as predictor of dropout is less certain. Given the traditional focus on achievement, no critical mass of evidence has emerged.

Finally, the meta-analysis examined only K-6 mobility and included both normative (expected) and non-normative (unexpected) moves. Estimates across a wider range of grades would strengthen knowledge about the impact of timing of mobility. In addition, greater focus on non-normative moves also is warranted, especially within the context of other subgroup effects such as family, child, and study characteristics. They also can be prevented. The extent to which the effects of non-normative moves vary by frequency of mobility and by thresholds also needs further exploration.

2. Meta-Analysis of Mobility

2.1. Methods

In our synthesis, mobility was defined as any change in schools between kindergarten and high school. We selected studies emphasizing non-normative or unexpected changes in schools. Studies that exclusively assessed normative or grade-promotion school changes were excluded, although the extent to which the studies distinguished between the two types of moves varied. Because they are planned and occur in cohorts, normative moves would be expected to have different patterns of effects than non-normative moves.

To be included in the synthesis, the studies were required to have all of the following features:

1. Measure school mobility for individual children from kindergarten to high school. Studies that did not distinguish between school and residential mobility were included.

2. Published or completed (unpublished) from 1990 through the end of 2008.

3. Assessed as outcomes reading achievement, math achievement, or school dropout/completion. These could be standardized test scores or general achievement. We coded but did not analyze grade retention and special education placement.

4. Reported estimates controlling for pre-mobility school achievement or performance either through covariance adjustment, regression, matching, or other techniques. With two exceptions, pre-mobility achievement was assessed by standardized tests scores or grades.

5. Conducted in the United States.

We followed a three-step procedure to identify studies. First, searches were conducted of the computerized databases ERIC; "Onesearch", an integrated database that includes ESBCO, PsychoInfo, and Education Full Text; and ProQuest. Key words included school mobility, school transfer, academic achievement, and residential mobility. Second, the abstracts and descriptors of the retrieved studies were examined to identify additional studies. For example, relevant reports from the earlier meta-analysis (Mehana & Reynolds, 2004) and other reviews (Rumberger, 2003) were investigated. Third, manual searches of the reference lists of identified articles were made as were those of well-known previous studies and projects. We included only articles published in peer-reviewed journals, ERIC documents, research reports, and dissertations.

2.2. Description of Identified Studies

Based on these criteria, we identified 16 studies for review (12 studies of achievement and 5 studies of dropout; one study overlapped). 26 studies were excluded primarily because they did not meet the pre-mobility achievement criterion (see Appendix A for references). Some of these studies also assessed school-level rather than student-level mobility, were conducted to assess the influence of other schooling experiences or broader models of adjustment, or investigated mobility as a mediator and not as a direct effect. We further note that although studies measuring mobility in high school were included, those only assessing mobility beginning in Grade 10 or later were excluded (this aspect was not analyzed in Swanson & Schneider, 1999). Because the focus was school mobility, studies of residential mobility were included only if school changes were also assessed.

Insert Table 1 here

Table 1 shows the summary of study characteristics, including samples, study design, control variables, measures of mobility and academic achievement, and representative unweighted effect sizes. The studies varied substantially in size and scope as well as social context. They are summarized as follows:

--5 used national probability samples including 4 from the National Educational Longitudinal Study of 1988 (NELS) and 1 from the National Longitudinal Study of Adolescent Health (NSAH) on school dropout (South et al., 2007). Three of the NELS studies assessed reading and math achievement (Pribesh & Downey, 1999; Ream, 2005; Swanson & Schneider, 1999) and two focused on school dropout (Rumberger & Larson, 1998; Swanson & Schneider, 1999). Each used somewhat different measures of mobility.

–9 were of large urban districts or public school systems including 3 from the Chicago Longitudinal Study (CLS; Ou & Reynolds, 2008; Reynolds & Bezruczko, 1993; Temple &

Reynolds, 1999), 2 from the Beginning School Study in Baltimore City (Alexander et al., 1996, 1997) and 1 from New York City (Heinlein & Shinn, 2000) and suburban Seattle (Gruman et al., 2008). The remaining studies were very large samples of public elementary schools in Texas (Hanushek et al., 2004; Mao et al., 1997). The Chicago and Baltimore projects are life-course cohort studies.

–2 were longitudinal studies of Head Start in Indiana that examined short-term effects on achievement (Mantzicopoulos & Knutson; 2000; Knutson, 1998).

Two other features of the studies are notable. The rates of mobility varied widely from 3% in NSAH to 73% in the CLS. This was a function of the interval of time assessed and socioeconomic context. We also note the wide range of ages of assessment of mobility. They varied from first grade only (Alexander et al., 1997) to grade 8 to 10 (Swanson & Schneider, 1999). Several were cumulative over much of elementary schooling (Alexander et al., 1996; Rumberger & Larson, 1998; Temple & Reynolds, 1999). Some also mixed home and school moves (e.g., Knutson, 1998; Pribesh, & Downy, 1999; South et al., 2007).

2.3. Methodological Quality

Table 2 shows the summary of our assessment of the methodological quality of the studies, including statistical/measurement validity, internal validity, and external validity. For the most part, the studies had relatively large sample sizes with high rates of sample recovery, measured mobility and outcomes reasonably well, and included relatively extensive sets of covariates known to predict mobility or school performance. A primary covariate is pre-mobility achievement.

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Insert Table 2 here

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Although all the studies had at least moderate levels of control, we classified 9 of the 16 studies as demonstrating a high level of statistical/methodological control because they included at least 3 of the 4 categories of covariates in Table 1 or had multiple waves of pre-mobility achievement, and exhibited other methodological attributes that strengthen validity such as measurement validity, statistical power, and analysis of mediators or dosage levels. The primary categories of covariates were prior achievement, SES, parent education, and family structure.

Despite the strengths of the studies, several shortcomings also are notable. Only two provided subgroup estimates by student characteristics (Hanushek et al., 2004; Temple & Reynolds, 1999). One study (South et al., 2007) investigated different mediators of effects but none did comprehensively. Few studies also assessed nonlinear and threshold effects, differential effects of timing of mobility as suggested by Mehana and Reynolds (2004), and the interaction of timing and frequency. Among studies examining timing, only a limited range of grades was assessed.

Although many studies assessed mobility via student reports (prospective or retrospective), only for the NELS studies of school dropout was mobility reported simultaneous to youth reports of dropout. While a validity threat, this limitation was minimized to some extent by the large number of control variables included in the models, some of which are likely mediators. Statistical overcontrol also was a potential threat in other studies (Hanushek et al., 2004; Reynolds and Bezruczko , 1993; Swanson & Schneider, 1999). Four of the 5 dropout studies assessed the outcome through self-reports. One assessed dropout through school records

supplemented with self-reports (Ou & Reynolds, 2008). Rates of dropout varied widely across studies.

The studies of achievement were based on a variety of standardized tests of reading and math with good psychometric properties. In contrast to other studies, Hanushek et al. (2004) reported estimates of math effects in annual gains rather than cumulative achievement.

2.4. Coding of Study Attributes

The following features were coded (contact the authors for further information)

Background characteristics. We coded author, year of publication, publication sources, study sample size, sampling procedure, research design (e.g., longitudinal or cross-sectional), covariates, method of analysis, subgroup analysis, and sample recovery/missing data.

Method of analysis. Statistical tests, level of significance, and sources of effect size calculation (e.g., r to d, adjusted means, metric or standardized regression coefficients, and odds ratios to d) were recorded.

Indices of school mobility. These included the number of school moves, dummy-coded mobility at particular thresholds, and mobility measures as school moves or a combination of school and residential moves. Timing of mobility also was included.

Outcomes. With one exception, the studies used standardized test scores from well-known tests, including the Iowa Tests of Basic Skills and California Achievement Tests. Gruman et al. (2008) used teacher ratings of academic performance, which are moderately to highly correlated with tests scores. The grade at outcome varied substantially, from Grade 2 to 12. We coded but did not analyze grade retention and special education placement (contact authors for further information).

School dropout was measured as failure to earn a high school diploma primarily from youth reports. Ages of report ranged from grade 8-10 to two years after high school. With the exception of Ou & Reynolds (2008), GED recipients were coded as dropouts.

Covariates/moderators. These included a wide range of individual (e.g., gender, race/ethnicity, and prior achievement), parent (e.g., SES, family structure, home language, residential mobility), school (school SES, school practices, quality), and neighborhood factors (e.g., poverty, urbanicity). Grade at outcome measurement also was used as a moderator in subgroup analysis.

2.5. Calculation of Effect Sizes

We converted all estimates to the standardized mean difference (Cohen's d) or standard deviation (SD) units, which is the mean for mobility group minus the mean for the nonmobile or less mobile group divided by the pooled standard deviation. Mobility was considered the "treatment" and the nonmobility or less frequently mobile group was the comparison group. In cases of marginal effects (change in outcome per each additional move), we estimated the impact of 3 moves or more versus no moves assuming linearity for studies that did not report threshold levels. In some studies, estimates were converted to SD units from the correlation between number of moves or threshold values.

For school dropout, effect sizes were calculated based on the probit transformation, tetrachoric transformation (for odds ratios), and r to d conversions (Lipsey & Wilson, 2001; Rosenthal et al., 2006). We separately coded unadjusted and adjusted coefficients. The studies used different sets of covariates, and we emphasized the estimates that included the most

comprehensive set of factors, including prior achievement and family background. Many studies included covariates that may be predicted by mobility. They are likely to have conservative bias.

We also corrected for small sample size bias by weighting effect sizes by the reciprocal variance (Lipsey & Wilson, 2001; Rosenthal et al., 2006). Consistent with Mehana and Reynolds (2004), we assigned a sample size weight of 2,000 to the national and Texas studies in order to reduce their influence on the overall findings. The next largest sample size was 1,286. Homogeneity of effect sizes was assessed to determine if significant variability exists across studies. This was followed by multiple regression analysis to assess whether study characteristics (e.g., type of mobility measure, grade level, prior achievement, and family SES) predict variation in effect sizes.

2.6. Major Findings

Overall, we found a significant relation between mobility and the 3 measures of school performance. As expected, mobility was associated with lower achievement and higher rates of school dropout. The weighted and unadjusted effect sizes for reading and math achievement were, respectively, -0.12 SD and -0.14 SD per each additional move (see Table 3). Effect sizes for frequent school mobility (threshold of 3 or more moves versus none) were -0.26 and -0.34 SD, respectively. The unweighted effect sizes were slightly larger. An effect size of a third of a standard deviation is equivalent to approximately 3 to 4 months of performance.

Figure 1 shows that the adjusted effect sizes for achievement were -.07 and -.08 SD per each additional move, respectively, for reading and math achievement. Frequent mobility (3 or more moves) had effect sizes of -0.21 and -0.23 SD, respectively. These values are based on the most representative and comprehensive model estimates from each study as reported in Table 2. The control variables typically included prior achievement, SES, and other factors, some of which were measured after moves occurred. Estimates varied by model specification. Values based on regression analyses controlling for grade at outcome, prior achievement, and family SES were larger (Appendix B2). Each additional move was associated with reductions of 0.10 and 0.12 SD, respectively, for reading and math achievement. Three or more moves were associated with reductions of 0.30 and 0.37 SD, respectively.

As displayed in Figure 1 and described in Table 4, the mean overall effect size for school dropout was 0.28 SD with a median value of 0.30 SD. These are unweighted estimates. They are adjusted for reported differences in pre-mobility achievement and many other covariates. Because only five studies of dropout were included, we did not estimate differences in effect sizes per move and for frequent moves. Inspection of Table 4 indicates, however, that more frequent mobility is associated with substantially higher rates of dropout. Each additional move is associated with about a 0.10 SD increase in dropout. As described below, this adjusted effect size on dropout corresponds to an increased mean rate of school dropout of 8.4 percentage points and increased median rate of school dropout of 6.6 percentage points. These are practically significant.

Insert Tables 3 and 4, Figure 1 here

2.6.1. Reading and Math Achievement

Of the 12 reviewed studies reported achievement effects, 10 reported statistically significant findings. Knutson's (1998) study of Head Start children and Reynolds and Bezruczko's (1993) analysis of grade 4 reading achievement in the CLS were the only ones that did not. Estimated effect sizes were heterogeneous for reading and math ($F = 6.14$, $p < .001$; $F = 5.83$, $p < .001$, respectively).

Overall marginal effects in Table 3 were generally similar by study participant characteristics including for reading achievement, income level (low income = -0.10 vs -0.08 SD, others) and urbanicity (urban = -0.11 vs -0.11 SD for suburban). There was some evidence that effects on reading achievement varied by the grade in which mobility occurred. This is best illustrated for frequent mobility. Frequent elementary-school moves were associated with an effect size of -0.35 SD whereas middle-school moves were nearly half this size (-0.18 SD). Frequent high school moves were associated with a reduction of 0.23 SD. No such pattern was found for math achievement.

The specification of covariates had the largest influence on effect sizes. Values in Table 3 were generally within the range of -.05 and -.10 SD for marginal effects and -.15 and -.25 for frequent moves. For example, estimates for the impact of each additional move were -0.04 and -0.07 SD, respectively, for studies that included prior achievement. They were -0.12 and -0.24 SD, respectively, for frequent mobility (3 or more moves; see Table 3). These are relatively modest effects. Across specifications, the effect size for math achievement is generally interpreted as within the range of practical significance. Estimates for reading achievement generally were not within the range of practical significance. As with the overall estimates, unweighted effect sizes were larger.

In regression analysis of variation in effect sizes across studies (Appendix B1 and B2), mobility type (frequency or dummy-coded), prior achievement, and family SES were significant predictors of the strength of the relation between mobility and academic achievement. Grade at outcome or mobility measurement did not account for significant variation in effects.

2.6.1.1. Threshold and Dosage Effects

Not evident in Table 3 and Appendix B1 and B2 is the pattern of effect sizes as a function of an increasing number of moves. Many studies did not measure the number of moves but rather more versus fewer moves or one or more moves versus no moves. This relates to the issue of gradient or threshold effects, which if observed can strengthen causal inference (Reynolds, 2005; Susser, 1973). Two studies are illustrative. As in-depth cohort studies beginning at the start of the schooling process, they have measured mobility and its predictors comprehensively.

In the Baltimore study, Alexander et al. (1996) found a significant linear association between the number of moves (both normative and non-normative) in grade 1 to 5 and reading scores on the California Achievement Tests. Moves were measured from school records. Of those remaining in Baltimore City schools (568 of 767 children), 41% moved at least once. 21% had 1 move, 13% 2 moves, 4% 3 moves, and 2% had 4 or more moves. For the full model specification, each additional move was associated with a 0.11 SD reduction in reading achievement. Assuming linearity, this indicates that 2 moves is associated with a 0.22 SD reduction, 3 moves with a 0.33 SD reduction, and 4 moves with a 0.44 SD reduction relative to the school-stable children. Given the small sample sizes, extrapolation beyond 3 moves deserves caution.

Mobility had a smaller effect on math achievement (-0.07 SD) and the linear coefficient was not statistically reliable in the full model. Of further note was that the addition of prior achievement and family background controls reduced the magnitude of the mobility-achievement association by 60% or more. Nevertheless, the coefficient for reading achievement and grades were significant in all models. The findings indicate that children who move frequently are at the highest risk of school underachievement above and beyond pre-mobility predictors.

Temple and Reynolds (1999) tested both a linear relation between the number of moves from kindergarten to grade 7 and thresholds defined at 1, 2, 3, and 4 or more moves. Mobility was measured from school records as non-normative moves. Among the 1,087 black children (Hispanic children were excluded) from the original sample of 1,539, 73% moved 1 or more times. 30% had 1 move, 22% 2 moves, 12% 3 moves, 6% 4 moves, 2% 5 moves, and 1% 6 moves. Although the full linear model indicated that each additional move was associated with a .07 SD reduction in reading achievement in grade 7, the threshold model had a better fit and indicated that children with 4 or more moves had a substantially larger effect size (-.39 SD) than for those with fewer moves (range of -.10 to -.19). The same pattern held for math achievement. This indicates that a high number of moves has more detrimental effects than implied by the linear model. Since most other studies did not investigate threshold effects, findings from the Alexander et al. (1996) study described above and others may be conservative.

A related finding was that children who moved 3 or more times but attended high quality magnet schools or academies by seventh grade had significantly higher test scores (by over .50 SD) than other students regardless of whether they moved. Finally, similar to the Baltimore study, the inclusion of prior achievement and other controls reduced the size of mobility effects by about 50% from the unadjusted model. This indicates the importance of controlling for prior performance. Once this factor is controlled, however, the effect of mobility remained stable regardless of the addition of further control variables.

2.6.2. School Dropout

Findings indicated that mobility was associated with higher rates of school dropout. This was particularly the case for frequent mobility. All 5 studies reported at least some evidence that mobility predicted higher rates of school dropout. Only 1 of the studies (Alexander et al., 1997) did not show statistically significant differences in the adjusted model that included prior performance and family background. A possible explanation is that mobility was assessed only in first grade.

Evidence about the relative impact of the timing was inconclusive given the relatively small number of reviewed studies. Even among those that did examine timing of mobility, no clear evidence was found. Findings indicted that elementary and high school mobility are linked to higher rates of dropout. Data were insufficient on mobility in early childhood as there was only 1 study that exclusively measured early mobility (Alexander et al., 1997).

The overall finding that mobility was associated with higher rates of dropout are particularly meaningful and indicative that the effect size is interpretable as a predictive relationship. Effect sizes were consistent across a heterogeneous set of study characteristics. Three studies were national probability samples from two different projects (NELS and NSAH). The two others were extensive cohort studies from large urban districts in Chicago and Baltimore serving high proportions of low-income children.

Grade of mobility measurement also varied substantially from first grade only to the high school years. The intervals of time captured by the mobility measures ranged from one to eight years. Findings were generally consistent across these different measurement intervals. A similar pattern of effects was found across the near entire span of the dropout distribution. Measured rates of dropout ranged from 3.2% in the NSAH study to well over 50% in the CLS. Yet effect sizes were consistently detected in the models.

Consistent effects also were found despite differences in sources and type of mobility measurement. In the national studies, parents reported mobility. South et al. (2007) measured both home and school moves. The Baltimore study used parent reports, and the Chicago study was based on school records. Likewise for school dropout, four studies were based on youth reports; the Chicago study was from school records supplemented with youth reports. Only the Chicago study and one NELS study (Rumberger & Larson, 1998) reported findings on threshold effects. Finally, the model specifications differed across studies. Although each study included an extensive array of covariates, including pre-mobility performance the national studies included as many as 25 covariates, some of which may measure mediating influences. Even in the presence of statistical over-control, these studies found that mobility was linked to higher dropout.

2.6. Limitations of the Meta-Analysis

We note two limitations of the review. First, findings are likely to be representative of relatively high-quality studies that account for pre-mobility achievement. They may not be representative of the 26 excluded studies or others not identified. Even without controlling for prior achievement, some excluded studies may have an interpretable pattern of findings. This deserves further exploration. Nevertheless, our findings dovetail with the previous meta-analysis (Mehana & Reynolds, 2004) that included a large number of studies that did not assess pre-mobility achievement. This increases the generalizability of the findings of the current study.

Second, two sources of potential bias were evident in the studies that may lead to conservative estimates of the effects of mobility. One is that most studies analyzed categorical variables for mobility that assessed the impact of any moves versus no moves or more frequent versus less frequent moves without testing the presence of threshold or dosage effects. Since there is evidence that frequent moves are most associated with underachievement, inclusion of count or threshold measures of mobility would likely increase rather than decrease effect sizes.

Another source of potential bias was that in an attempt to reduce omitted-variables bias, some studies included control variables that were measured after mobility occurred and may be more appropriately conceptualized as mediators accounting for the direct effect of mobility. Examples would be characteristics of elementary and high schools, parent involvement, student engagement, and academic performance (Alexander et al., 1997; Hanushek et al., 2004; Heinlein & Shinn, 2000; Reynolds & Bezruczko, 1993; Rumberger & Larson, 1998; Swanson & Schneider, 1999). The absence of a significant link between number of school moves and reading achievement in Reynolds and Bezruczko (1993), for example, was likely due to the inclusion of parent involvement and need for remedial education, which were measured during or after moves occurred. Estimates based on models with these potential mediators denote the influence of mobility after removing sources of its connection to outcomes. Consequently, the magnitude of effects would be smaller. The extent to which these sources of potential bias compensate for sources of potential bias that lead to “liberal” estimates of effects deserves further study. None of

the studies, for example, completely accounted for variation in school success or the prediction of mobility status.

2.7. Summary

Findings indicated that across well-controlled studies, mobility was consistently associated with lower achievement and higher rates of high school dropout. Findings were larger, more consistent, and of greater practical significance for school dropout than for achievement. Effect sizes for reading and math achievement were of general practical significance and were largest for frequent mobility. Effect sizes for reading achievement were for the most part smaller than for math, and in some models (see Table 3) were small. Moves occurring in elementary school and high school were associated with more detrimental effects on reading and math achievement than moves in middle school. Effect sizes were found to be similar by SES study characteristics and by urbanicity, although 3 studies report more negative effects for central-city students (Alexander et al., 1996; Hanuschek et al., 2004; Temple & Reynolds, 1999). The inclusion of prior achievement and family and child factors substantially reduced the magnitude of effects but effect sizes remained statistically reliable for at least some measures in 13 of the 16 studies.

A number of issues were not sufficiently assessed or investigated in the studies and deserve further analysis. One is the long-term impact of school mobility on achievement beyond 3 or 4 years and on school dropout and educational attainment into adulthood. Most of the reviewed studies examined only shorter-term effects.

A second issue needing further investigation is the separate and joint effects of timing and frequency of mobility. Timing was not tested within studies to any meaningful extent. Further examination of nonlinear and threshold effects also are needed. Only two studies tested nonlinear and threshold effects whereas most other studies assumed a linear relation between the number of moves and outcomes. Differences by reason for moving, for different subgroups, and by type of move (i.e., residential vs. school) also need more extensive investigation.

Similarly, analysis of the mediators of the impact of mobility deserves further assessment as only two studies documented the extent to which mobility effects are explained by school, peer, or family factors. This need is accentuated by the wide variation in settings that children encounter. The new school and social contexts and their quality may account for substantial variation in observed effects.

Finally, although we focused on school performance, the effects of mobility on socioemotional development, health status and behavior, and family/parenting outcomes warrant investigation as do the direct and indirect effects on schools and communities. The importance of this expansion of outcomes was indicated in many studies (e.g., Alexander et al., 1996; Hanushek et al., 2004; Reynolds & Bezruczko, 1993).

3. Mobility Analysis in the Chicago Longitudinal Study

To further explore issues raised in the meta-analysis, we analyze data and report findings from one of the included projects–the Chicago Longitudinal Study (CLS, 2005). The CLS is a prospective investigation of the life course of a cohort of 1,539 children (93% black, 7% Hispanic) from low-income families born in 1979-1980 who attended early childhood programs in 1985-1986. Although the entire sample participated in early intervention services, it is general representative of children at risk of school failure in Chicago.

The study has unique strengths in investigating mobility effects. It has extensive information on child well-being before and many years after moving, includes annual administrative records on mobility that are independent child performance, has extensive information on child, family, and school influences affecting performance from multiple sources, a high rate of sample recovery, and a focus on children with high rates of mobility.

3.1. Count, Timing, and Threshold Effects

Evident from the meta-analysis was the lack of attention to the possible nonlinear and threshold effects of mobility as well as differential effects by age of move. Table 5 shows the prevalence rates of mobility during elementary school. We conducted a series of hierarchical regression analyses to test the effects of school mobility between kindergarten and grade 8 on grade 8 reading achievement (Iowa Tests of Basic Skills) and highest grade completed by age 25. Mobility was measured in three different ways: (1) as a count variable representing the number of years from K-8 in which students changed schools, ranging from 0 to 7 move years; (2) as two count variables representing the number of years from K-4 and grade 4-8 in which students changed schools, each ranging from 0 to 4 move years; and (3) as three indicator variables for students who changed schools one year, two years, and three or more years between kindergarten and grade 8.

Insert Tables 5 and 6 here

As shown in Table 6, an extensive set of control variables were included in the second step of the model to account for associated risks for poor achievement as well as potential moderators and mediators of school mobility effects on reading achievement and educational attainment. Indicator variables denoting African American ethnicity, female gender, participation in CPC preschool, and participation in CPC grade school programs were included as controls. Similarly, continuous achievement scores from a standardized test of word analysis in kindergarten were included to control for students' achievement levels prior to experiencing school mobility.

Because there can be a variety of reasons for changing schools, we hypothesized that the relationship of school mobility to later outcomes may differ depending on the situation. Specifically, lower risk families with more resources may elect to move their children to magnet schools, private schools, or out of the city with the goal of providing their children with a better education. In higher risk families with fewer resources, most school changes likely result from financial hardship and residential instability rather than preference. Thus the four additional indicator variables, high family risk status, magnet school attendance, private school attendance, and moves to schools outside of Chicago, were also included. Students were given the indicator of high family risk status based on the presence of four or more of the following demographic risk factors in early childhood: mother was less than 18 when child was born, mother did not complete high school, single parent, 4 or more children in household, AFDC participation, mother not employed, eligible for free lunch, and 60% or greater poverty in school attendance area. Students were given indicators for magnet school attendance and private school attendance if they ever attended a magnet or private school between kindergarten and grade 8, and they were given an indicator for moving to schools outside of Chicago if their school records ever indicated a leave code denoting that they had moved out of the city. In the final step of the regression

models, 3 variables were included as potential mediators of effects of school mobility. Indicator variables were used to represent whether students had experienced child abuse and neglect, whether students had ever been retained for a grade in school, and whether students had ever been placed in special education between kindergarten and grade 8.

Appendix F and G display the predictors of any versus no school moves and 3 or more versus others. The most consistent predictors across models were residential mobility, family and neighborhood poverty, cognitive skills at kindergarten entry, and gender.

3.1.1. Reading Achievement

As shown in Table 6, findings from the first model demonstrated a robust relationship between the number of school moves and reading achievement. In the covariance-adjusted model, number of moves was significantly associated with lower achievement. Each additional move was associated with a 1.5 point reduction in reading achievement, about 1 to 1.5 months of performance. In the most comprehensive model, which controlled for all family background and school experience variables including the mediators of child abuse/neglect, grade retention, and special education, school moves continued to be significantly associated with lower levels of reading achievement. However, the mediators accounted for some of this relationship.

The second model examined the effects of mobility during two different time periods, kindergarten to grade 4 and grade 4 to 8. Findings indicated some evidence that later moves are more detrimental to achievement. Controlling for the influence of covariates, moves during grade 4-8 were significantly associated with reading achievement but grade K-4 moves were not. In the most comprehensive model, which includes the mediators of child abuse/neglect, grade retention, and special education, neither measure of mobility was linked to reading achievement. Their influence was accounted for, in part, by the mediators.

In the third regression model, school mobility was examined with indicator variables for the number of move years including 1 move year, 2 move years, and 3 or more move years. (Students with 0 move years are the reference group). Findings indicated that only 3 or more moves was associated with significantly lower reading achievement. In the covariance-adjusted model that included prior achievement, and move location, the frequent move group had reading scores that were on average 5.5 points lower than the school-stable group. This is about 5 months of performance. These findings are consistent with Temple and Reynolds (1999). In the most comprehensive model, there was evidence that the mediators accounted for about half of the main effect of 3 or more moves on achievement.

3.1.2. Educational Attainment

As shown in Table 7, we also assessed the effects of mobility on educational attainment. This was measured as the highest grade in school each student completed by the age of 25 (mean = 11.94 years). Similar to the achievement analysis, a series of hierarchical regressions were conducted. For these models, grade 8 reading achievement and juvenile delinquency were included as mediators in the most comprehensive model. Overall, findings were consistent with those for reading achievement. Number of moves was significantly associated with lower levels of educational attainment. Each additional move was linked to a one-tenth of a year reduction in education. Mobility from grade 4-8 was more associated with lower attainment than mobility from K-4. This relation held in the most comprehensive model (see Appendix C for findings on K-12 mobility and residential mobility).

Insert Table 7 here

Regarding thresholds, 3 or more moves was significantly associated with lower educational attainment but fewer moves were not. Youth who moved 3 or more times had a third of a year less education than youth who were school-stable. Notably, grade 8 reading achievement and delinquency accounted for 20 to 25% of the main effect of mobility measures when they were added as mediators. Moreover, they were strong independent predictors of educational attainment in their own write.

3.2. Mediation of the Link Between Mobility and School Success

Another limitations of the reviewed studies was the lack of investigation of the mediators or mechanisms through which mobility led to lower academic success. Only 2 of the 16 studies examined the contributions of mediators (Pribesh & Downey, 1999; South et al., 2007). This state of affairs is significant for two reasons. First, causal explanation is unclear. How does mobility compromise achievement? The identification of mediators strengthens inferences about the validity of estimated effects. Such analyses have a long history in epidemiology (Susser, 1973), psychology (MacKinnon, 2008), and evaluation research (Reynolds, 2005) of increasing confidence that the identified links are real and not due to unmeasured factors.

Second, mediational analysis assesses the indirect effects of mobility on academic performance and attainment. Although the review found that mobility had a direct effect on measures of school performance, indirect effects or more complex processes may also be at work. None of the studies measured indirect effects of mobility. For example, mobility may link to lower reading and math achievement through its impact on socioemotional adjustment, peer relations, or school commitment and engagement. Mobility also may affect classroom and school processes in the new school that detract from learning. Mobility has been found, for example, to mediate the effect of child maltreatment on school performance, as maltreated children often receive out-of-home placements in foster care or are adopted. Mobility also has been found to mediate the effect of preschool intervention on child maltreatment (Reynolds & Robertson, 2003). Moreover, it accounts for links between preschool and adult well-being (Reynolds & Ou, 2009).

Insert Figure 2 here

More broadly, mobility can be viewed as part of a wide array of child, family, and school influences that contribute to learning and development in complex ways. Figure 2 depicts a set of five mediators through which the effects of early childhood experiences are transmitted to child well-being. Conceptualized as the five-hypothesis model of the effects of early intervention (Reynolds, 2000), the hypotheses are (1) cognitive advantage, (2) social adjustment hypothesis, (3) family support behavior, (4) motivational advantage, (5) school support hypothesis (classroom and school learning environments). In this model, mobility is a measure of school support experiences that directly affect well-being into adulthood but also contributes to well-being indirectly through its mediating influence on early childhood experiences. By extension,

mobility can be hypothesized as a mediator of the effects of family risk and other early experiences (e.g., poverty) on well-being as well as the other four hypothesized mediators.

Insert Figure 3

Figure 3 illustrates the complex contributions of mobility to 3 measures of adult well-being at age 24: felony arrest, depressive symptoms, and occupational prestige. Reynolds and Ou (2009) tested a structural equation model of the effects of CPC preschool through the five hypotheses described above. Shown are the major significant standardized paths (coefficients are omitted but generally exceed .10) of the good-fitting models in which measurement errors are taken into account. Notably, the influence of mobility is identified net of the influence of other factors (e.g., school quality) in the model. Appendix H provides a list of references for additional studies.

Although school mobility is predicted by a number of factors, for all three outcomes mobility contributes either directly, indirectly or both. For felony arrest, mobility is a direct predictor and it indirectly influences felony arrest through juvenile arrest and high school completion. The same pattern occurred for depressive symptoms at age 24. Mobility had both direct and indirect effects. For occupational prestige, in influence of mobility was indirect.

These analyses show that the discontinuities created by mobility have impacts that are independent of other adjustment processes and contribute both directly and indirectly to later well-being. Analysis of educational attainment using the same model and matched measures with another intervention study–the High/Scope Perry Preschool Project–further corroborate the complex influences of mobility on life course outcomes (Reynolds et al., 2009).

3.3. Summary

Findings from the Chicago Longitudinal Study show that in more comprehensive models school mobility was significantly associated with lower reading achievement in grade 8 and higher rates of dropout. Children who move frequently and children who move after grade 4 are more negatively affected than other children. About one quarter of the estimated effect of mobility was accounted by intervening school experiences. Moreover, mobility was found to have indirect effects on measures of well-being ranging from achievement and school attainment to adult arrest and occupational prestige. Mobility also has been found to be a significant mediator of the links between preschool participation and later well-being. These findings are suggestive of the complex effects of mobility that are just beginning to be fully investigated.

4. Strategies to Reduce Mobility and its Negative Consequences

4.1. Summary of Strategies

Many types of programs, services, and policies have been developed to reduce rates of mobility or lessen its potentially negative consequences. These include peer buddies and mentoring (Cornille, Bayer, & Smyth, 1983; Titus, 2007); orientation and transition programs for new students (Cornille et al.); social skills training (Durlak, 1997; Elias et al., 1985; Jason et al., 1993); whole school reforms such as Schools of the 21st Century (Zigler et al., 2006) and the School Development Program (Comer et al., 1999), which are designed to strengthen service

continuity and integration; curriculum models such as the International Baccalaureate Program (see Titus, 2007) and others (McCarthy & Still, 1993); the system developed by the Department of Defense Education Activity (Smrekar & Owens, 2003); and general improvement in the quality of schools through professional development, small classes and parental involvement (Popp, Stronge, & Hindman, 2003; Reynolds, 2000). School district policies that encourage flexible attendance areas, transportation for mobile students, and collaboration with housing and other service agencies to maintain school stability also are more common (Kerbow, 1996). The enactment of state and federal legislation to provide transition supports for mobile children is a further option. For example, in the federal McKinney-Vento Homeless Education Assistance Act, students are allowed to remain in their original school after moving from the attendance area with transportation provided.

Based on a study of existing practices in the Armed Services, the Military Child Education Coalition (see Popp et al. 2003; Titus, 2007) made a number of recommendations to schools in promoting the success of children in transition including (a) timely transfer of student records, (b) immediate orientation and assignment of transition buddy for new students, © professional development targeted to mobile students, and (d) reciprocal requirements for course substitutions, waivers, and testing.

4.2. Preschool-to-Third Grade (PK-3) Models

Although a wide array of strategies are available to address school mobility, very few have been empirically evaluated. Intensive and comprehensive prevention programs, presumably one of the most desirable approaches, also have been rarely investigated for their impact on mobility. One comprehensive school reform model is called preschool-to-third grade education (PK-3) or alternatively, extended early childhood programs. As an organizational model, the PK-3 approach provides a framework of services that are co-located, instructionally-aligned, and encourage school stability from preschool to kindergarten, and the early school-age years.

Based on the growing empirical base (Bogard & Takanishi, 2005; Reynolds, 2003; Takaniski & Kurez, 2008), four attributes of PK-3 programs and practices are key to their success: continuity, organizational structure, instruction, and family support services. The first two features are particularly relevant. Continuity emphasizes programs and practices that support consistency and task orientation such as school stability, reducing the negative effects of mobility, and the importance of smooth transitions. Structure emphasizes the coordination and integration of services within a particular school setting such as preschool, kindergarten, and school-age components of a comprehensive program approach.

4.3. Child-Parent Center PK-3 Approach

We illustrate the PK-3 model of the Child-Parent Center and Expansion (CPC) Program. In contrast to many other programs and approaches, CPC was specifically designed to promote continuity and stability in schooling, it has been thoroughly investigated for effectiveness, and has been the subject of cost-benefit analysis. Given the historic separation of preschool and K-12 education, the PK-3 model is particularly salient for aligning and co-locating these service systems. Because only one-third of Head Start programs are located in schools and most schools do not offer preschool services, the vast majority of children change locations between preschool and kindergarten. The CPC program reduces the need for such transitions. It was designed to encourage stable and predictable early learning experiences for young children and their families.

Continuation services in the primary grades can help strengthen or maintain the effects of earlier experiences.

The CPC program opened in 1967 through funding from Title I of the Elementary and Secondary Education Act of 1965. Title I provides block grants to school districts serving relatively high percentages of children from low-income families. The program was established as a school and community response to improve student attendance, parental involvement, and language and communication skills (Reynolds, 2000). Although continuing services were not part of the original model, preschool graduates attended kindergarten in 1968 and then three years of school-age services. By the mid 1980s, 25 centers were in operation. The program is unique in that preschool to third grade services are run by a single school site under the direction of a Head Teacher.

Insert Table 8 here

Table 8 shows the main characteristics. The program provides comprehensive educational and family-support services to economically disadvantaged children and their parents from preschool to early elementary school. Most notable is the opportunity to enroll at age 3, small classes of 17 children and 2 teaching staff in preschool, 25 to 2 in the following years, and an intensive parent involvement component.

4.3.1 Program Groups

The CLS study enrolled a complete cohort of 989 children who completed preschool and kindergarten in all 20 CPCs with combined programs and 550 low-income children who did not attend the program but instead participated in a full-day kindergarten intervention in five randomly selected schools and in schools affiliated with the CPCs. About 15% of the comparison group attended Head Start preschool Thus, in contrast to many previous studies, the comparison group enrolled in enriched early childhood services available for low-income children in Chicago. School-age services are provided in first to third grades in affiliated schools regardless of children's earlier participation.

Based on the alternative-intervention, quasi-experimental design, the comparison group matched the program group on age, eligibility and participation in intervention, and neighborhood and family poverty. By comparing groups that received different intervention services, findings test the impact of CPC above and beyond other available early childhood services. This is likely to result in a conservative bias compared with many previous studies. Investigations of potential selection bias using a variety of procedures from propensity score to latent variable modeling show strong robustness of estimated effects (Arteaga et al., 2009; Reynolds et al., 2009; Reynolds & Temple, 1995, 2007).

As described elsewhere (Reynolds et al., 2007; Reynolds, 2004), participation in the CPC program has been found to be significantly associated with higher levels of school achievement, parent involvement in children's education, and with lower rates of remedial education, child maltreatment, and delinquency and crime (Reynolds, 2000). Children participating in the extended program (4 or more years of services) displayed lower rates of school remedial services and delinquency (Reynolds et al., 2001). At the age 24, preschool and extended intervention were associated with higher well-being in multiple domains including high school completion, 4-year college attendance, or full-time employment (Reynolds et al., 2007).

4.3.2. Program Impacts on School Mobility

We analyzed the effect of CPC program participation on school mobility. The findings are based on up to 1,400 study participants of the original 1,539. Table 9 shows estimates of the marginal effects of CPC participation for three measures of school mobility from grades 4 to 8 (see Appendix D for mobility rates by CPC program participation). We chose this interval to emphasize longer-term effects and because school-age participation is confounded with mobility from kindergarten to grade 3. Mobility was assessed from yearly school records of the Chicago public schools from ages 10-14, and included the number of moves, any mobility, and 2 or more moves.

The impact of preschool participation, school-age participation, and extended intervention (4-6 years vs. all others) was assessed. The effects of preschool and school-age participation were estimated simultaneously to control for each other's influence. Gender, race/ethnicity, and eight demographic factors (e.g., parent education, single-parent family status) known to predict mobility were also included as covariates. Estimates of the impact of extended participation were tested separately, and also included as a covariate kindergarten word-analysis test scores. Estimates with corrections for potential attrition bias using propensity scores are also reported in Table 9 but they did not meaningfully change coefficients. We emphasize the findings without these corrections.

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Insert Table 9 here

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Findings from ordered probit and probit regression for 1,361 CLS participants indicated that participation in the CPC extended program was associated with significantly lower levels of later mobility (see Appendix E for results for grade 4 to 12 mobility). Adjusted for family background, the CPC extended group had 0.47 fewer moves than the comparison group with less extensive participation (0.67 vs 1.14, $p < .001$). Their rate of any mobility was lower than the comparison group by 17.7 percentage points (50.3% vs 68.0%; $p < .001$). Their rate of 2 or more moves was lower by 13.9 percentage points (32% vs 18.1%; $p < .001$), a reduction of 43% over the comparison group.

CPC preschool and school-age participation were also associated with lower levels of mobility after the end of the program. Relative to the comparison group, preschool participants had 0.26 fewer moves (0.94 vs 1.20; $p < .001$) and a 9.3 percentage-point lower rate of mobility (70% vs 60.7%; $p < .001$). Their rate of multiple moves was also 9.3 percentage points lower (34.0% vs 24.7%, $p < .001$), which was a 27% reduction over the comparison group.

School-age participation showed a similar pattern of findings, with the exception being that the reduction in the rate of 2 or more moves was borderline significant (5.8 point reduction, 31% vs 25.2%; $p < .10$). This was a 19% reduction over the comparison group. These findings dovetail with additional findings in Appendix E and those studies listed in Appendix H.

4.3.3. Economic Returns of the CPC Program Associated with Mobility

Based on the accumulated effects of the CPC program on mobility and a wide range of

indicators of well-being, two cost-benefit analyses have been conducted at age 21 (Reynolds et al., 2002) and age 26 (Reynolds et al., 2009). Cost-benefit analysis is increasingly prominent approach for documenting the magnitude of benefits of prevention programs (O'Connell, Boat, & Warner, 2009).

As shown in Table 10, findings indicated that all three components of the program have positive economic returns. We emphasize the age 26 findings. At an average cost in 2008 dollars of $8,839 per child for 1.5 years, the preschool program returned an average of about $90,000 per child in societal benefits due to higher earnings capacity projected from educational attainment, lower criminal justice system costs, and lower rates of child maltreatment as well as other health benefits. This is a return of $10-11 per dollar invested.

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Insert Table 10 here

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At a cost of $5,361 above and beyond less extensive services, the CPC extended intervention was found to return an average of approximately $45,000 per child or $8-9 per dollar invested. School-age services alone had a smaller but positive return.

Based on the implied effects in Figure 3 and analyses by Reynolds, Ou, & Topitzes (2004) and Reynolds and Ou (2009), we estimated the percentage of the preschool benefits from educational attainment and crime (the largest share of economic returns) contributed (mediated) by school mobility measured by 2 or more moves from ages 10-14. School mobility was found to account for 16% of the main effect of preschool on educational attainment and 13% on involvement in the criminal justice system. These lead to age-26 economic benefits accounted by school mobility exclusive to education and crime of $10,524 per participant or $1.19 per dollar invested. Even under the unlikely assumption that mobility contributes zero percent to the other benefit categories, this is a sizable contribution.

How much does the CPC PK-3 model cost above and beyond the typical programs and services that are already provided in public schools? Adding two years of a part-day CPC preschool beginning at age 3 and three years of first to third grades services would cost on average $17,472 per child in discounted 2008 dollars. Expanding to full-day preschool would increase these costs while costs would be lower in schools that are already providing preschool services. At a minimum, these costs are recovered within a few years and culminate in higher returns over time. Reducing mobility, or alternatively promoting continuity, is one explanation for these benefits.

4.4. Summary

In summary, the results show the beneficial effects of the CPC PK-3 program and its components in promoting school stability in the elementary grades. These findings hold in further analyses that account for other predictors of mobility and school success including parent involvement, cognitive skills, school quality, and teacher ratings of classroom adjustment (see Appendix H). In these more comprehensive analyses, different measures of mobility have been found to contribute to the transmission of effects to achievement, educational attainment, and other outcomes. Analyses of a wider range of studies will further document the contributions of mobility to children's learning and development.

5. Discussion

This report adds to the long history of research indicating that mobility is negatively associated with achievement and educational attainment. As the findings from our synthesis show, mobility contributes to performance deficits. Findings corroborate through research synthesis and primary analysis of data that mobility is a meaningful predictor of school underachievement and dropout. The meta- analysis showed the consistent and significant negative impact in 14 of the 16 studies. This was especially true for frequent mobility.

Although the research has advanced in isolating the effects of mobility from other confounding influences, further corroboration is needed before certain types of mobility can be established as a causal influence. The meta-analysis and additional analyses do reveal that frequent school mobility for urban school children is consistently linked to lower school achievement and higher school dropout across a wide range of specifications. Inferences are strongest for the frequent movers. Examination by age, frequency, reason, and subgroups was limited but revealed variability by age, frequency, and risk levels. Children in urban contexts who move frequently appear to be most negatively affected. This was corroborated in further analysis of the Chicago study. More specific findings on the variability of effects, such as the proportion of all movers who either affected positively, negatively, or not at all is needed to better understand the full scope of impacts on children.

Our findings highlight the need to implement a range of interventions and policies to reduce mobility when feasible and its negative consequences. As exemplified by the PK-3 education model, comprehensive reforms to strengthen continuity of children's development through integration of services during important transitions are needed. The CPC program has shown promising results in reducing the prevalence of mobility, which contributes to demonstrated long-term effects and cost-effectiveness. Evidence was presented that more than 10% of the total economic return of CPC preschool from education and crime is linked to reductions in mobility net of other influences. Certainly, expansion of the PK-3 model and linkage to middle childhood and adolescence is warranted. Other promising interventions include the routine provision of transition services for students moving to a new school, whole-school reforms, curricular reforms that increase uniformity of instruction, flexible school enrollment policies, and general improvement in the quality of schools.

Four areas of research will advance knowledge about the determinants and effects of mobility. The first is measurement. Although annual national data on residential mobility are collected by the Census Bureau, parallel data on school mobility are not available. On-going measurement is needed on the extent of school mobility both annually and over time. State and local communities do collect these types of data but they are rarely longitudinal and complete. The types of information needed would include measures of the timing and frequency of mobility within and across years, reasons for moving, co-occurrence of residential moves, distances moved, characteristics of the new settings, and differences between settings. One recommendation on measurement is to add items on school moves to Annual Social and Economic Supplement to the Current Population Survey, which currently assess only residential moves. The NAEP assessments ended collection of student-reported school moves in 2000. Consideration should be given to continue collecting these data.

The second area of research need is studies to strengthen internal validity and understanding about the nature of the relationship between mobility and various indicators of well-being. Few of the reviewed studies examined impacts more than a few years after the assessment of mobility. Similarly, studies rarely examined the possibility of nonlinear, threshold, and dosage effects. In conjunction with timing of mobility, these mixed dimensions of mobility deserve further investigation. Moreover, analysis of mediational processes and mechanisms is needed. Many hypotheses have been forwarded to account for the negative (or positive) effects of mobility but few empirical tests have been conducted. To strengthen inferences and reduce specification errors, multiple hypotheses should be assessed simultaneously, including peer, cognitive, socioemotional development, family, and school characteristics and quality. Research on preschool programs is illustrative of multiple hypothesis testing to account for direct effects (see Figure 2 and Reynolds & Temple, 2008). These foci will enhance internal validity and confidence about causal inferences on the impact of mobility.

The third focus is to increase generalizability of findings for different subgroups. Few of the reviewed studies examined the heterogeneity of impacts by move reason, child and family subgroups, and characteristics of pre- and post-mobility settings. Although average effects provide a general indication of impact for the typical child, mobility occurs for many reasons and transpires across many contexts and child characteristics. Documenting, for example, the proportion of movers that may derive positive as well as negative effects over particular periods of time would strengthen knowledge on the variability of effects. Based on two of the reviewed studies (Hanushek et al., 2004; Temple & Reynolds, 1999), it appears that two subgroups benefit from moving: those moving to higher quality schools and those transferring to suburban or rural schools. In contrast, two other groups appear to experience detrimental effects: frequent movers and central-city movers remaining within their districts (Alexander et al., 1996; Hanushek et al., 2004; Rumberger & Larson, 1998; Temple & Reynolds, 1999). Also important to investigate are the effects by distance of the move, family demographic groups, and child characteristics such as pre-mobility achievement.

Finally, more studies are needed of the impacts of mobility on other indicators of well-being such as socioemotional outcomes, attitudes and expectations, health behaviors, socioeconomic status, and family behavior. Complex indirect effects on schools and neighborhoods also warrant investigation, as these influences are just beginning to be understood. Such studies will help establish a critical mass of knowledge on multiple domains of functioning. By addressing these and other recommendations, future research on the effects of mobility and the benefits of prevention programs will contribute to a more complete understanding of its many dimensions.

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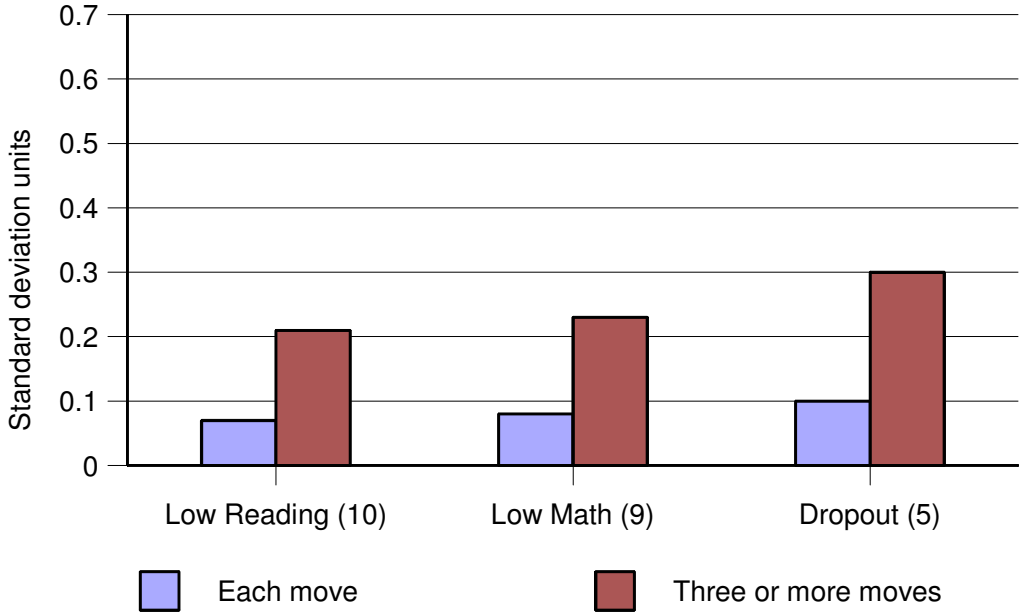
Figure 1. Adjusted Mean Effect Sizes for 3 Outcomes



Note. For consistency with dropout, reading and math achievement are shown as low scores. Values are adjusted for a comprehensive set of covariates measured in the individual studies, and include prior achievement. Effects are based on one estimate in 10 studies for reading, 9 for math, and 5 for school dropout (see Table 2 and 3 for further details and estimates).

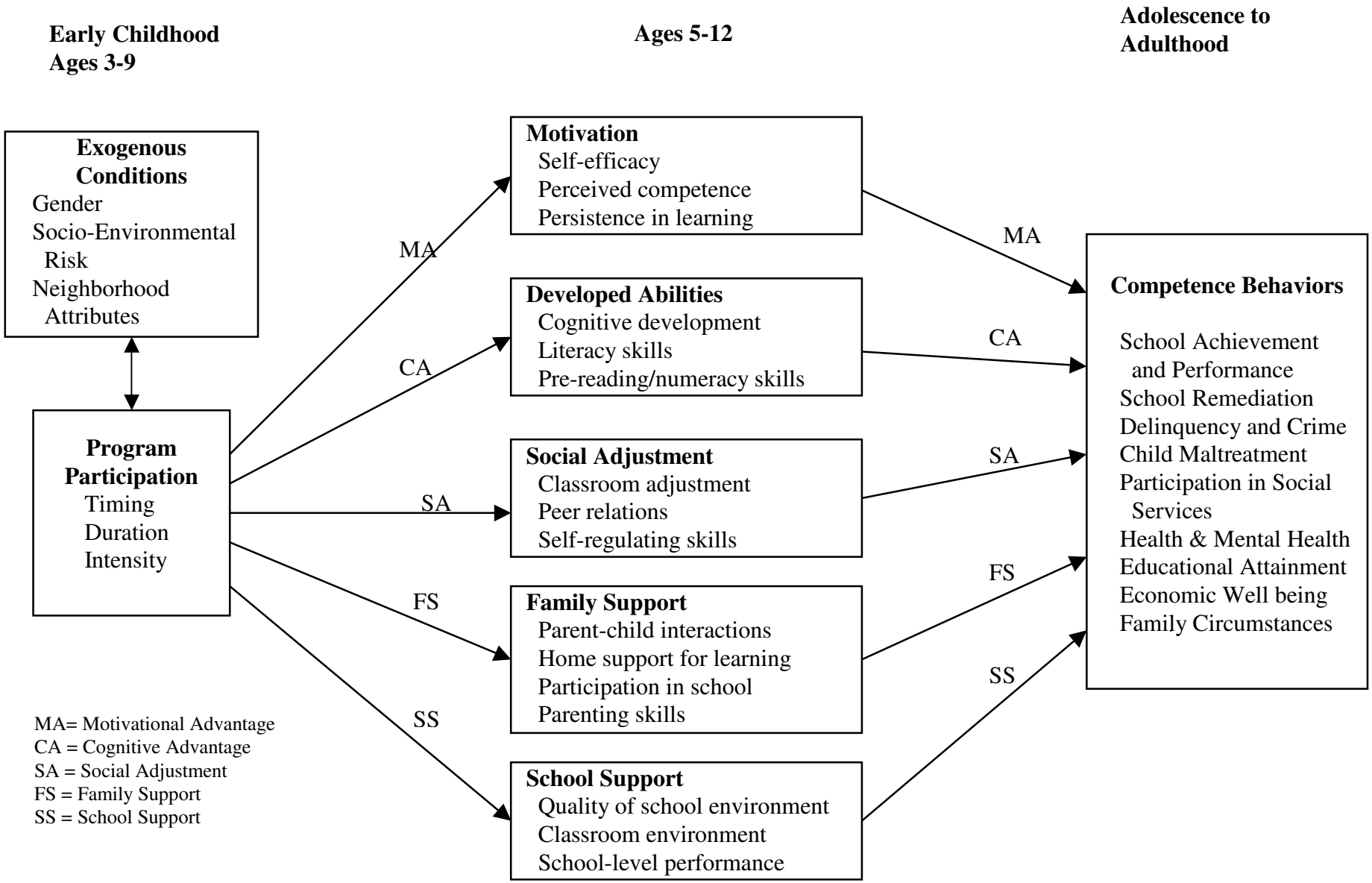


Figure 2. Common Paths from Early Childhood to Adult Well-Being

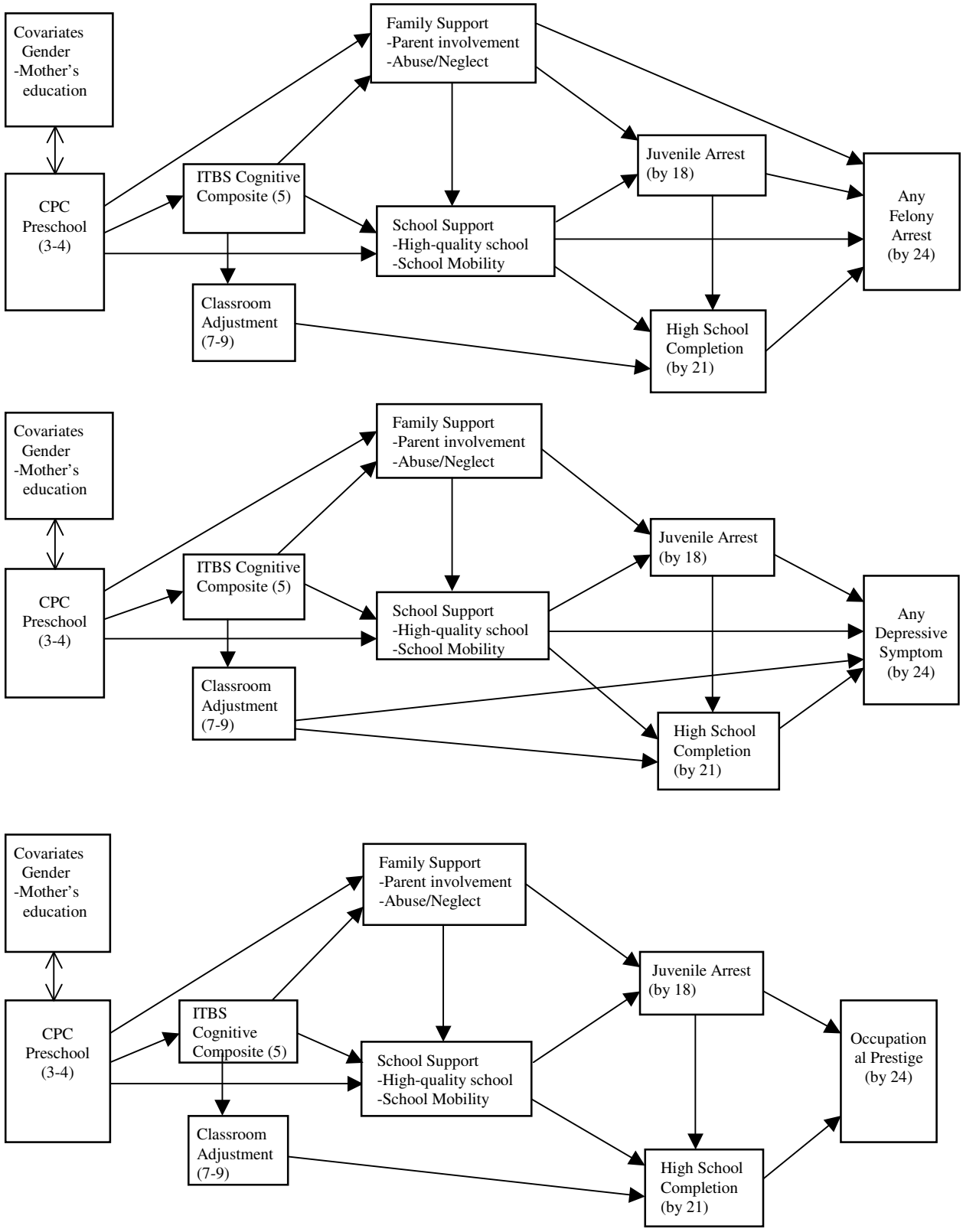


Figure 3. Paths of Influence of the CPC Preschool to Adult Well-Being in Structural Models

Table 1. Summary of Study Characteristics of 16 studies

Studies		Sample characteristics	Study design	Covariates				Student mobility	Academic achievement	Unwei .ES
				Prior achievement	SES	Parent education	Family structure			
Alexander, Entwisle, & Dauber (1996)	Beginning School Study	568 (representative sample balanced by race/ethnicity and SES; stayers)	Longitudinal	√	√	√		• Number of school transfers year 1 through year 5	CAT reading and math in grade 5	R.= -.11 M.= -.07
Alexander, Entwisle, & Horsey (1997)		548(representative sample balanced by race/ethnicity and SES)	Longitudinal	√			√	• Number of school changes in grade 1	High school dropout	D. = .12
Mantzicopoulo& Knutson (2000)	Head Start	90 (children came from economical disadvantages families	Longitudinal	√				• Number of school transfer over 3 years (K-grade 2)	WJ-R reading and math in grade 2	R.= -.16 M.= -.22
Knutson (1998)		172 (low-income children)	Longitudinal	√				• Number of school and residential changes in k-grade 2	WJ-R Reading and math in grade 2	R.= -.01 M.= -.01
Temple & Reynolds (1999)	Chicago Longitudinal Study	1087 (low-income, black children)	Longitudinal	√	√	√		• Number of school moves between K-grade 7	ITBS reading and math in grade 7	R.= -.07 M.= -.07
								• 1 move, 2 moves, 3 moves, & 4 or more moves between K-grade 7		R. (1M.)= -.11 R. (2M.)= -.17 R. (3M.)= -.19 R. (4M.)= -.35 M. 1M.)= -.10 M.(2M.= -.14 M.(3M.= -.27 M.(4M.= -.34
Reynolds, & Bezruczko (1993)		1255 (low-income, black children)	Longitudinal	√	√	√		• Number of school moves from K to grade 3	ITBS Reading in grade 4	R.= -.07

Note. R. "reading" M. "math" D. "dropout" 1M. "1 move" 2 M. "2 moves" 3 M. "3 moves" 4 M. "4 moves"

Unwei. ES " unweighted effect size", drawn from the most comprehensive model which was controlled for prior achievement and other covariates.

Table 1. Summary of Study Characteristics of 16 studies (continued)

Studies		Sample characteristics	Study design	Covariates				Student mobility	Academic achievement	Unwei .ES
				Prior achievement	SES	Parent education	Family structure			
Ou & Reynolds (2008)	Chicago Longitudinal Study	1286 (low-income, black children)	Longitudinal	√	√	√	√	• 1 move (ages 10-14) • 2 moves (ages 10-14) • 3 moves or more (ages 10-14)	High school completion by age 2o (converted to school dropout)	D. (1M.)= .15 D. (2M.)= .37 D. (3M.)= .62
Swanson & Schneider (1999)	National Education Longitudinal Study	12518 (nationally representative sample of adolescents)	Longitudinal	√	√	√	√	• Number of school changes in grades 1 to 8	High school dropout in grades 8-10 Gain in math	D.= .08
								• Any school changes in grades 8-10 • Any school+residential changes in grades 8-10		
Pribesh & Downey (1999)		14929 (nationally representative sample of adolescents)	Longitudinal	√	√	√	√	• Number of residential and school mobility (grades 1-12)	Reading and math in grade 12	R.= -.05 M.= -.09
								• Number of school-only move (grades 1-12)		R.= -.04 M.= -.03
								• Number of residential-only move (grades 1-12)		R.= -.02 M.= -.05
Rumberger & Larson (1998)		11671 (low-income, black children)	Longitudinal	√	√		√	• Number of school moves grades 1-8) • 1 and 2 or more school moves Grades 8-12	Dropout in grade 12-14	D. = .04 D = .31 (1) D = .54 (2)
Ream (2005)		12048	Longitudinal	√	√			• Number of school move in 1-grades 8	Reading and math in grades 8	M. Me.=-.02 Wh.=-.13 R.= Me.=.11 Wh.=-.11
								• Number of school move in grades 8-12	Reading and math in grade 12	M.= Me.=-.15 Wh.=-.03 R.= Me.=.03 Wh.=.00
								• Number of residential move in grades 8-12		M.= Me.=-.02 Wh.=-.08 R.= Me.=-.12 Wh.=-.03

Note. R. "reading" M. "math" D. "dropout" 1M. "1 move" 2 M. "2 moves" 3 M. "3 moves" 4 M. "4 moves" Me. "Mexican" Wh. "white"
Unwei. ES " unweighted effect size", drawn from the most comprehensive model which was controlled for prior achievement and other covariates.

Table 1. Summary of Study Characteristics of 16 studies (continued)

Studies		Sample characteristics	Study design	Covariates				Student mobility	Academic achievement	Unwei .ES
				Prior achievement	SES	Parent education	Family structure			
South, Haynie, & Bose (2007	National Longitudinal Study of Adolescent Health	8516 (randomly sampled)	Longitudinal	√	√	√	√	• Any residential and school moves	School dropout	D.= .31
Heinlein & Shinn (2000)	New York City Community School Districts	764 (a largely minority, low-income, English - speaking population)	Longitudinal	√	√			• 2+moves in grade 4-6	CAT reading and math in grades 3 and 6	R.= -.06 M.= -.09
								• 3+moves in k-grade 6, • 2+moves in K-grade 3, • 3+moves in grades 4-6, • early and late school move (before and after grade 3)		
Mao, Whitsett, & Mellor (1997)	Texas public schools	1,493,436 in grades 4-8 (1994-1995)	Cross-sectional	√	√			• Student enrollment at different schools within the school year (grades 4-8)	Reading and math in grades 4-8	R.= -.11 M.= -.08
Hanushek, Kain, & Rivkin (2004)		>600,000 in 3 cohorts (1994-1997	Longitudinal	√	√			• Any school moves • Multiple moves in academic year (2 moves)	Math in the highest grade (grades 4-7)	M.=-.05 (annual gain, multiple movers)
Gruman, Harachi, Abbott, Catalano, & Fleming (2008)	Raising Healthy Children Project	1003 children	longitudinal	√	√			• Total number of school changes	Teacher-rated academic performance	Combined =-.04

Note. R. "reading" M. "math" D. "dropout" 1M. "1 move" 2 M. "2 moves" 3 M. "3 moves" 4 M. "4 moves"

Unwei. ES " unweighted effect size", drawn from the most comprehensive model which was controlled for prior achievement and other covariates.

Table 2. Summary of Study Quality of 16 Studies

Study / Quality indicators	Alexander, Entwisle, & Dauber (1996)	Alexander, Entwisle, & Horsey (1997)	Mantzicopoulo & Knutson (2000)	Knutson (1998)	Temple & Reynolds (1999)	Reynolds, & Bezruczko (1993)	Ou & Reynolds (2008)	Swanson & Schneider (1999)
	Beginning School Study		Head Start		Chicago Longitudinal Study			National Education Longitudinal Study
Statistical/Measurement Validity								
1.Sample size	568 (stayers)	548	90	172	1087	1255	1286	12518
2.Recovery rate	72%	69%	None	No report	76%	82%	84%	76%
3.Analysis of missing data (none, general description, or modeling)	Description	Description	None	None	Modeling	Modeling	Modeling	Modeling
4. Signif. detected at .05 in the adjusted model	Yes	No	Yes	No	Yes	Yes	Yes	Yes
5. Representative effect size in the adjusted model	R.= -.11; M.=-.07	D. =.12	R.= -.16; M.=-.22	R.= -.01; M.=-.01	R.= -.07; M.=-.07 (n of moves)	R.= -.07 (n of moves)	D. =.28 (any) D = .62 (3+)	D.=.08 (Number) D = .16 (s), .22 (h)
6. Grade at outcomes	Grade 5	Grade 12	Grade 2	Grade 2	Grade 7	Grade 4	Age 20	Grades 8-10
7.Precision of mobility: (prevalence (0/1), count, or thresh)	Count	Count	Count	Count	Count and thresholds	Count	Thresholds	Count and prevalence
8. Independence of Mobil/Outcome Measure	Yes (school records/standardized test)	Yes (school records/self report)	Yes (school records/standardized test)	Yes (school records/standardized test)	Yes (school records/standardized test)	Yes (school records/standardized test)	Yes (school records/standardized test)	Yes (questionnaire/ standardized test)
Internal Validity								
9.Description of school moves (mobility rate)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10.Description of background characteristics of sample	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None
11. Level of control (low, med, or high)	High	Med	Med	Med	High	High	High	High
12. Mediation	None	None	None	None	None	None	None	None
External Validity								
13. Range of age of mobility	Grades 1-5	Grade 1	K-grade 2	K-grade 2	K-grade 7	K-grade 3	Ages 10-14	Grades 1-8
14. Sample context	Public schools	Public schools	Suburban public schools	Suburban public schools	Urban inner city, public school	Urban inner city, public school	Urban inner city, public school	Not specified
15. Subgroup analysis	Yes (background factors)	None	None	None	Yes (School quality)	None	None	None
16. Move reason (none, partial, or full)	Partial information	None	Full information	Full information	Partial information	None	None	None

Table 2. Summary of Study Quality for 16 Studies (continued)

Quality indicators / Study	Pribesh & Downey (1999)	Rumberger & Larson (1998)	Ream (2005)	South, Haynie, & Bose (2007)	Heinlein & Shinn (2000)	Mao, Whitsett, & Mellor (1997)	Hanushek, Kain, & Rivkin (2004)	Gruman et al. (2008)
	National Education Longitudinal Study			National Longitudinal Study of Adolescent Health	New York City Community School Districts	Texas Public Schools		Raising Healthy Children Project
Statistical/Measurement Validity								
1.Sample size	14929	11671	12048	8516	764	1,493,436	>600,000	1003
2.Recovery rate	62%	89%	75%	<88%	No report	No report	No report	96%
3.Analysis of missing data (none, general description, or modeling)	Modeling	None	None	None	None	None	None	none
4. Signif. detected at .05 in the adjusted model	Yes	Yes	Yes	Yes	No	Yes	Yes	No
5. Representative effect size in the adjusted model	R.= -.04; M.=-.03 (number of school moves)	D. =.04 (Number) D = .31 (1) D = .54 (2+)	R.= - .02; M.=-.09 (school move 8-12)	D.=.31	R.= -.06; M.=-.09	R.= -.11; M.=-.08 (1-year gain)	M.=-.05 (multiple moves (annual gain)	Combined =-.04
6. Grade at outcomes	Grade 12	Grade 12-14	Grades 8 & 12	Grade 12	Grade 6	Grades 4-8	Grades 4-7	Grade 5
7.Precision of mobility: (prevalence (0/1), count, or thresh)	Count	Count and Threshold	Count	Prevalence	Count and prevalence	Prevalence	Prevalence	count
8. Independence of Mobil/Outcome Measure	Yes (questionnaire/standardized test)	Yes (questionnaire/standardized test)	Yes (questionnaire/standardized test)	No (interview/interview)	Yes (School records/Standardized test)	Yes (School records/Standardized test)	Yes (School records/Standardized test)	Yes (School records/Teacher-rated)
Internal Validity								
9.Description of school moves (mobility rate)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
10.Description of background characteristics of sample	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
11. Level of control (low, med, or high)	High	High	Med	High	Med	Med	High	Med
12. Mediation	Yes	None	None	Yes	None	None	Limited	None
External Validity								
13. Range of age of mobility	Grades 1-12	Grade 1-8 Grade 8-12	-8 Grades 8-12	Before Grade 8	K-grade -6	Grades 4-8	Grade 4-7	Grades 1-6
14. Sample context	Not specified	Not specified	Not specified	Not specified	urban	State of Texas	State of Texas	Suburban
15. Subgroup analysis	None	None	None	None	None	None	None	None
16. Move reason (none, partial, or full)	None	None	None	None	None	None	None	None

Table 3. Average Effect Sizes of the Number and the Threshold of School Move (3 or More Moves) on Reading and Math Achievement by Study Characteristics

Study characteristics	Number of school moves					Threshold of school moves (3 or more moves)				
		Reading		Math			Reading		Math	
	N[a]	Uw. d	W. d	Uw. d	W. d	N[a]	Uw. d	W. d	Uw. d	W. d
Overall	34/32	-.12	-.09	-.14	-.11	37/36	-.34	-.26	-.42	-.34
Participants										
Not specified	22/22	-.09	-.08	-.11	-.11	22/23	-.27	-.25	-.34	-.34
Low-income children	12/10	-.17	-.10	-.21	-.10	15/13	-.46	-.29	-.56	-.33
Sample procedures										
Randomized Sampling	18/18	-.09	-.08	-.11	-.11	18/18	-.26*	-.25	-.34	-.34
Convenient Sampling	16/14	-.15	-.10	-.17	-.10	19/18	-.42	-.29	-.49	-.34
School area										
Urban	8/6	-.12	-.11	-.10	-.10	11/9	-.34	-.33	-.33	-.33
Suburban	11/11	-.18	-.11	-.21	-.12	11/11	-.55	-.34	-.63	-.36
Not specified	15/15	-.07	-.07	-.10	-.11	15/16	-.20	-.22	-.33	-.34
Grade level at outcomes										
Elementary	18/16	-.16	-.12	-.18	-.12	19/17	-.47	-.35	-.52	-.34
Middle	3/3	-.02	-.04	-.07	-.09	5/6	-.16	-.18	-.34	-.36
High	13/13	-.08	-.08	-.11	-.11	13/13	-.23	-.23	-.33	-.33
Model specification										
No control of covariates	8/7	-.26**	-.21**	-.31**	-.25**	9/8	-.73**	-.62**	-.87**	-.73**
Control of covariates	26/25	-.07	-.05	-.09	-.07	28/28	-.22	-.14	-.29	-.23
Prior achievement level										
None	20/19	-.16*	-.13*	-.18*	-.15+	23/22	-.46*	-.37*	-.51	-.43
Control	14/13	-.05	-.04	-.08	-.07	14/14	-.16	-.12	-.27	-.24
Family SES										
None	17/16	-.19**	-.15**	-.22**	-.17*	18/17	-.57**	-.46**	-.65**	-.52*
Control	17/16	-.04	-.04	-.06	-.06	19/19	-.13	-.12	-.21	-.22
Prior achievement + family SES										
None	26/25	-.14*	-.11+	-.16	-.13	29/28	-.42*	-.34*	-.46	-.38
Control	8/7	-.03	-.02	-.07	-.06	8/8	-.08	-.07	-.25	-.24
Prior achievement + family SES + others										
None	28/27	-.13	-.10	-.15	-.12	31/31	-.39	-.30	-.45	-.37
Control	6/5	-.04	-.03	-.06	-.06	6/5	-.12	-.10	-.19	-.19

Note. "N[a]" showed the number of effect sizes for reading and math, respectively. "Uw. d" is unweighted effect size d."W. d" is weighted effect size d.
+ "p<.05" * "p<.01" **"p<.001"

Table 4. Adjusted Rates of School Dropout for 5 Well-Controlled Studies of Mobility

Study	Moves grades	Assessment		Mobility group	Stable group	Difference	d
		Grade	Measure				
Alexander, Entwisle, & Horsey (1997)	1 (s)	14	num-1	45%	40.0%	5.0%	.12
			2	50%	40.0%	10.0%	.24
			3	55%	40.0%	15.0%	.36
Ou & Reynolds (2008)	4-8 (s)	14-15	any	58.5%	47.4%	11.1%	.28
			1	53.0%	47.4%	5.6%	.15
			2	61.0%	47.4%	13.6%	.37
			3	71.0%	47.4%	23.6%	.62
Swanson & Schneider (1999)	1-8 (s)	8-10	num-1	8.1%	7.0%	1.1%	.08
	8-10 (s)		any	9.3%	7.0%	2.3%	.16
	8-10 (h)		any	10.6%	7.0%	3.6%	.22
Rumberger & Larson (1998)	1-8 (s)	14	num-1	13.0%	12.0%	1.0%	.04
	8-12 (s)	14	1	19.5%	12.0%	7.5%	.31
			2+	26.0%	12.0%	14.0%	.54
South, Haynie, & Bose (2007)	< 8 (h+s)	10	any	5.9%	3.2%	2.7%	.31
Median						6.6%	.30
Mean						8.4%	.28

Note. School (s) and residential (s) moves are denoted. Grade 14 refers to two years post high school (Age 20). Coefficients reported in the articles (e.g., odds ratios, logit coefficients) were transformed to marginal effects and d based on tetrachoric and probit methods (Cohen & Cohen, 1983). Reference group rates were those for the total sample reported in the articles. All rates are adjusted for differences in pre-mobility achievement, family background and many other factors that vary across studies. The most comprehensive model reported in the studies was typically used to estimate adjusted rates.

Table 5. Descriptive Statistics for Mobility Variables

Variable	Mean or Percentage	Standard Deviation
School move years k-8	1.34	1.34
School move years k-12	1.56	1.49
School move years k-4	.76	.88
School move years 4-8	.58	.84
School move years 8-12	.22	.50
One school move (k-8) %	32.8	-
Two school moves (k-8) %	18.1	-
Three or more moves (k-8) %	17.5	-
One school move (k-12) %	32.3	-
Two school moves (k-12) %	18.5	-
Three school moves (k-12) %	10.6	-
Four or more moves (k-12) %	11.8	-

Table 6. Main Effects of Mobility K-8 for 8th Grade Reading Using Count, Timing, and Thresholds

	B	SE(B)	β	B	SE(B)	β	B	SE(B)	β
Step One:									
School moves k-8	-.31	.43	-.19***	-	-	-	-	-	-
School moves k-4	-	-	-	-2.26	.68	-.09**	-	-	-
School moves 4-8	-	-	-	-4.02	.71	-.16***	-	-	-
1 school move	-	-	-	-	-	-	-6.02	1.47	-.13***
2 school moves	-	-	-	-	-	-	-7.88	1.71	-.14***
3 or more moves	-	-	-	-	-	-	-12.13	1.73	-.22***
Step Two:									
School moves k-8	-1.55	.40	-.10***	-	-	-	-	-	-
School moves k-4	-	-	-	-1.04	.63	-.04	-	-	-
School moves 4-8	-	-	-	-2.07	.64	-.08**	-	-	-
1 school move	-	-	-	-	-	-	-1.93	1.34	-.04
2 school moves	-	-	-	-	-	-	-2.65	1.59	-.05
3 or more moves	-	-	-	-	-	-	-5.67	1.62	-.10**
ethnicity (AA)	-5.28	2.05	-.06**	-5.34	2.05	-.06**	-5.3	2.06	-.06**
gender (female)	6.24	1.03	.14***	6.24	1.03	.14***	6.25	1.04	.14**
CPC preshool	1.75	1.19	.04	1.57	1.21	.03	1.72	1.2	.04
CPC grade school	-1.06	1.19	-.02	-.84	1.21	-.02	-0.95	1.2	-.02
K achievement	.61	.04	.37***	.61	.04	.37***	0.61	0.04	.37***
High risk	-5.65	1.21	-.11***	-5.67	1.21	-.11***	-5.73	1.21	.12***
Magnet School	6.43	1.66	.10***	6.42	1.66	.10***	6.43	1.67	.10***
Private School	2.78	2.03	.03	2.78	2.03	.03	2.75	2.03	.03
Out of Chicago	-.75	1.57	-.01	-.89	1.57	-.01	-0.63	1.57	-.01
Step Three:									
School moves k-8	-.86	.38	-.05*	-	-	-	-	-	-
School moves k-4	-	-	-	-.07	.58	-.03	-	-	-
School moves 4-8	-	-	-	-1.03	.59	-.04	-	-	-
1 school move	-	-	-	-	-	-	-1.06	1.23	-.02
2 school moves	-	-	-	-	-	-	-1.82	1.45	-.03
3 or more moves	-	-	-	-	-	-	-2.75	1.5	-.05
ethnicity (AA)	-4.19	1.88	-.05*	-4.20	1.88	-.05*	-4.19	1.88	-.05*
gender (female)	2.71	.97	.06**	2.71	.97	.06**	2.68	0.98	.06**
CPC preshool	1.19	1.10	.03	1.14	1.11	.02	1.18	1.1	.03
CPC grade school	-1.72	1.09	-.04	-1.65	1.11	-.04	-1.64	1.1	-.04
K achievement	.41	.04	.25***	.41	.04	.25***	0.41	0.04	.25***
High risk	-4.42	1.11	-.09***	-4.43	1.11	-.09***	-4.48	1.11	-.09***
Magnet School	6.14	1.52	.09***	6.14	1.52	.09***	6.11	1.53	.09***
Private School	1.50	1.86	.02	1.50	1.86	.02	1.5	1.86	.02
Out of Chicago	-1.72	1.43	-.02	-1.77	1.44	-.03	-1.67	1.44	-.03
Abuse/Neglect	-14.7	1.16	-.30***	-14.63	1.16	-.30***	-14.63	1.16	-.30***
Retained	-2.83	1.45	-.04	-2.92	1.45	-.04*	-2.92	1.45	-.04*
Special Ed	-10.1	1.33	-.18***	-10.12	1.33	-.18***	-10.09	1.34	-.18***

Table 7. Main Effects of Mobility k-8 for Educational Attainment Using Count, Timing, and Thresholds

	B	SE(B)	β	B	SE(B)	β	B	SE(B)	β
Step One:									
School moves k-8	-.20	.03	-.16***	-	-	-	-	-	-
School moves k-4	-	-	-	-.07	.06	-.03	-	-	-
School moves 4-8	-	-	-	-.34	.06	-.17***	-	-	-
1 school move	-	-	-	-	-	-	-.18	.12	-.05
2 school moves	-	-	-	-	-	-	-.40	.14	-.09**
3 or more moves	-	-	-	-	-	-	-.82	.14	-.18***
Step Two:									
School moves k-8	-.08	.03	-.07**	-	-	-	-	-	-
School moves k-4	-	-	-	.02	.05	.01	-	-	-
School moves 4-8	-	-	-	-.18	.05	-.09**	-	-	-
1 school move	-	-	-	-	-	-	.09	.11	.03
2 school moves	-	-	-	-	-	-	-.05	.13	-.01
3 or more moves	-	-	-	-	-	-	-.31	.14	-.07***
Controls	-	-	-	-	-	-	-	-	-
Step Three:									
School moves k-8	-.06	.03	-.05	-	-	-	-	-	-
School moves k-4	-	-	-	.01	.05	.01	-	-	-
School moves 4-8	-	-	-	-.13	.05	-.07*	-	-	-
1 school move	-	-	-	-	-	-	.10	.11	.03
2 school moves	-	-	-	-	-	-	-.02	.13	-.00
3 or more moves	-	-	-	-	-	-	-.25	.14	-.06
Controls	-	-	-	-	-	-	-	-	-
8th grade reading	.02	.00	.24***	.02	.00	.24***	.02	.00	.24***
Juvenile delinquency	-.06	.11	-.15***	-.60	.12	-.14***	-.62	.11	-.15***

Table 8. Key Program Characteristics of the Child-Parent Center (CPC) Preschool-to-Third Grade Model

Characteristic	Description
Funding	Federal Title I and State Chapter I
Organization and Leadership	Head Teacher runs program in partnership with Principal And District Program Manager
Structure and Location	Elementary school or in close proximity, preschool to grade 3; Parent resource rooms in each school
Timing and Length	4-6 years beginning in preschool
Preschool	1-2 years
Kindergarten	60% full-day program
School-age	60% 1-3 years
Preschool + school-age	56% of preschool group, 36% overall
Class Sizes	17 to 2 in preschool and 25 to 2 in Kindergarten and school-age (teacher and aide)
Additional Staff	Parent Resource Teacher School-Community Representative Nurse and Health professionals Curriculum-Parent Resource Teacher (School-age)
Services and Activities	Educational/Instructional Coordination, alignment across grades Parent Program Health Services Resource mobilization in community Speech and language
Professional Development	Semi-annual meetings of systemwide staff

Table 9. Estimated Effects of CPC Program Participation on School Mobility Over Grades 4 – 8

Model	Marginal effects	School mobility (N = 1,361)								
		Number of school moves			Any moves vs. none			2 or more school moves vs. others		
		Unadj. mean difference	Adj. mean difference	Adj. mean difference-attrition	Unadj. Mean diff.	Adj. mean difference	Adj. mean difference attrition	Unadj. mean difference	Adj. mean difference	Adj. mean difference-attrition
Model 1	Preschool participation	-.364***	-.284***	-.279**	-.140***	-.093*	-.091*	-.123***	-.093***	-.091**
Model 2	School-age participation	-.328***	-.265**	-.240**	-.157***	-.123**	-.112*	-.095***	-.058*	-.046+
Model 3	Extended participation	-.452***	-.465***	-.440***	-.193***	-.177**	-.165**	-.159***	-.139***	-.130**

Notes:

1. Unadj. =Unadjusted; Adj. = Adjusted.
2. + p<.10, * p<.05, ** p<.01, *** p<.001.
3. Coefficients are from ordered probit and probit regressions transformed to marginal effects. Covariates used in these regressions are: preschool or school-age participation, sex of child, race/ethnicity, residence in high-poverty school, single-parent status, teen parenthood, mother was not a high school graduate, 3 or more children in family, public aid receipt, eligible for fully subsidized meals, and parent not employed. Extended participation also included kindergarten word analysis from the Iowa Tests of Basic Skills.
4. The attrition correction model includes a propensity score of being in the school mobility sample. This was calculated using probit regression. Covariates include: preschool and school-age participation, sex of child, race/ethnicity, family risk index of 8 demographic factors, whether risk index included imputed variables, word analysis in kindergarten, home environment problems from birth to age 5, have a social security number on file, mobility and labor force participation of the neighborhood census tracts (1980 census).

Table 10. Per Participant Societal Benefits and Costs in Present Value 2008 Dollars of the Child-Parent Center Program, Preschool-to-Third Grade

Component	Cost	Age 21 Report		Age 26 Report	
		NPV	B/C	NPV	B/C
Preschool	8,839	80,896	1.15	84,556	10.57
School-age	3,938	4,462	2.13	11,706	3.97
Preschool plus School-age (Extended)	5,361	43,611	9.13	39,397	8.35
School mobility contribution to preschool return on education and crime	--	11,606	1.31	10,524	1.19

Note: The net present value estimates and benefit-cost ratios for the age 21 and age 26 report include the value of averted tangible and intangible criminal victimization costs. Estimates are evaluated at age 3 using a 3% real annual discount rate. Estimates were converted to 2008 dollars using the Bureau of Labor Statistics' Consumer Price Index for all Urban Consumers (CPI-U). Contribution of school mobility was based on mediation analysis of educational and juvenile arrest, in which mobility (age 10-14) was evaluated after the inclusion of program and covariates.

Appendix A. Excluded Studies from the Meta-Analysis Study

Adduci, L. L. (1990). *Mobility and student achievement in Orange High School.* (ERIC Document Reproduction Service No. ED374920)

Astone, N. M., & McLanahan, S. S. (1994). Family structure, residential mobility, and school dropout: A research note. *Demography, 31,* 575-584.

Audette, R., & Algozzine, B. (2000). Within district transfers and student achievement: Moving ahead by staying in one place. *Special Services in the Schools, 16,* 73-81.

Audette, R., Algozzine, R., & Warden, M. (1993). Mobility and Student Achievement. *Psychological Reports, 72,* 701-702.

Alspaugh, J. W. (1991). Out-of-school environmental factors and elementary achievement in mathematics and reading. *Journal of Research and Development in Education, 24,* 53-55.

Buckner, J., Bassuk, E., & Weinreb, L. (2001). Predictors of academic achievement among homeless and low-income housed children. *Journal of School Psychology, 39,* 45-69.

Bruno, J. E., & Isken, J. A. (1996). Inter-intraschool site student transiency: Practical and theoretical implications for instructional continuity at inner city schools. *Journal of Research and Development in Education, 29,* 239–252.

Crowder, K., & Teachman, J. (2004). Do Residential Conditions Explain the Relationship Between Living Arrangements and Adolescent Behavior? *Journal of Marriage and the Family, 66,* 721-738.

Dunn, M. C., Kadane, J. B., & Garrow, J. R. (2003). Comparing Harm Done by Mobility and Class Absence: Missing Students and Missing Data. *Journal of Educational and Behavioral Statistics, 28,* 269-288.

Jennings, T. A., Kovalski, T. M. et al. (2000). *Predicting Academic Achievement Using Archival Mobility Data.* (ERIC Document Reproduction Service No. ED 449181)

Kaminski, L. R. G. (1999). *Here today and gone tomorrow: the impact of student mobility on learning.* Unpublished doctoral dissertation, Harvard University, Cambridge, MA.

Lee, V. E., & Smith, V. E. (1999). Social support and achievement for young adolescents in Chicago: The role of school academic press. *American Educational Research Journal, 36,* 907-945.

Liechty, S. J. (1994).*The effects of mobility on fourth grade students' achievement, attendance, and behavior.* Unpublished doctoral dissertation, Drake University, Des Moines, Iowa.

McCoy, A. R., & Reynolds, A. J. (1999). Grade retention and school performance: An extended investigation. *Journal of School Psychology, 37,* 273-298.

Mehana, M., & Reynolds, A. J. (1995). *The effects of school mobility on scholastic achievement.* (ERIC Document Reproduction Service No. ED385381)

Moore, B. L. D. (2003). *An exploration of the influence of demographic factors on individual and aggregate student achievement measurements in the Kentucky accountability system.* Unpublished doctoral dissertation, University of Louisville, Louisville, Kentucky.

NY Department of Education (1992). Student and teacher mobility: impact on school performance in New York City public schools. Albany, N.Y., The University of the State of New York, State Education Dept., Office for Planning, Research and Support Services.

Pribesh, S. (2005).*The consequence of residential and school mobility for adolescents*. Unpublished doctoral dissertation, Ohio State University, Columbus, Ohio.

Simpson, G. A., & Fowler, M. G. (1994). Geographic mobility and children's emotional/behavioral adjustment and school functioning. *Pediatrics, 93,* 303-309.

Teachman, J.D., Paasch, K., & Carver, K. (1996). School capital and dropping out of school. *Journal of Marriage and the Family, 58,* 773-783.

Texas Education Agency (1997). A Study of Student Mobility in Texas Public Schools. Statewide Texas Educational Progress Study Report No. 3, Texas Education Agency, Austin. Div. of Research and Evaluation.

Tucker, C., Marx, J. J., & Long, L. (1998). Moving On: Residential Mobility and Children's School Lives. *Sociology of Education, 71,* 111-129.

Wing, M. D. (2008). *Student transfer: The effect of timing on academic achievement*. Unpublished doctoral dissertation, University of Maine, Orono, Maine.

Wood, D., Halfon, N., Scarlata, D., Newacheck, P., & Nessim, S. (1993). Impact of Family Relocation on Children's Growth, Development, School Function, and Behavior. *Journal of the American Medical Association, 270,* 1334-1338.

Wright, D. (1999). Student mobility: A negligible and confounded influence on student achievement. *Journal of Educational Research, 92,* 347-353.

Zamudio, G. V. (2004). *Student mobility: The relationship between student population stability and academic achievement*. Unpublished doctoral dissertation, University of Arizona, Tucson, Arizona.

Appendix B1. Regression Models Predicting Reading and Math Achievement

	Reading				Math			
Predictor	Coef.	p	t	R^2	Coef.	p	t	R^2
1. Mobility type	-.10	+	-2.49	.03	-.12	*	-2.9	.05
2. Mobility type	-.09	+	-2.47	.05	-.12	*	-2.87	.04
Grade at outcome	.03		1.81		.01		.34	
3. Mobility type	-.09	*	-3.1	.42	-.12	**	-3.56	.38
Grade at outcomes	.03	+	2.15		.02		.88	
Control of covariates	.29	**	9.8		.31	**	8.88	
3. Mobility type	-.09	*	-2.64	.16	-.13	*	-3.02	.08
Grade at outcomes	.02		1.07		.00		-.2	
Control of prior achievement+family SES	.15	**	4.59		.10	+	2.53	
4. Mobility type	-.09	*	-3.08	.39	-.13	**	-3.43	.26
Grade at outcomes	.02		1.48		.00		0	
Prior achievement level	.12	**	4.45		.11	**	3.36	
Family SES	.19	**	7.17		.17	**	5.11	

Note. + “p<.05” * “p<.01” **”p<.001” Mobility type-number of school moves (continuous) was code 0 and threshold of school moves (non-continuous) was code

Appendix B2. Regression Models Predicting the Effect Size of the Number and the Thresholds of School Moves (3 or More Moves) on Reading and Math Achievement

	Number of school moves										Threshold of school moves (3 or more moves)									
	Reading					Math					Reading					Math				
Predictor	Coef.	p	t	R^2	Adj.d.	Coef.	p	t	R^2	Adj. d.	Coef.	p	t	R^2	Adj. d.	Coef.	p	t	R^2	Adj. d.
1. Grade at outcome	.02		.96	-.002	-.09	.00		.06	-.03	-.11	.05		1.01	.00	-.28	.01		.1	-.03	-.34
2. Grade at outcomes	.02		1.26	.53	-.09	.01		.37	.52	-.11	.05		1.34	.52	-.28	.02		.45	.47	-.36
Control of covariates	.17	**	6.13			.18	***	6			.47	**	6.19			.50	**	5.74		
3. Grade at outcomes	.01		.54	.14	-.10	-.01		-.38	.02	-.11	.03		.51	.14	-.28	-.01		-.2	-.01	-.34
Control of prior achievement+family SES	.09	*	2.49			.07		1.67			.26	+	2.6			.14		1.27		
4. Grade at outcomes	.01		.82	.47	-.11	-.01		-.4	.34	-.12	.04		.85	.47	-.30	.00		-.07	.26	-.37
Prior achievement level	.07	*	2.62			.08	+	2.44			.20	*	2.72			.17		1.85		
Family SES	.11	**	4.43			.10	*	3.38			.33	**	4.64			.28	*	3.11		
5. Prior achievement level	.08	*	3.1	.48	-.10	.07	+	2.5	.36	-.12	.22	*	3.3	.48	-.29	.17		2.0	.29	-.38
Family SES	.11	**	4.4			.11	**	3.5			.32	**	4.6			.28	*	3.3		

Note. + “p<.05” * “p<.01” **”p<.001” “Adj. d.”-mean effect sizes adjusted by the covariates in model specification 1-4.

Appendix C. CLS Main Effects of Mobility Using K-12 Mobility Measure (Count, Timing, and Thresholds)

	B	SE(B)	β	B	SE(B)	B	B	SE(B)	β
Step One:									
School moves k-12	-.22	.03	-.20***	-	-	-	-	-	-
School moves k-4	-	-	-	-.07	.06	-.04	-	-	-
School moves 4-8	-	-	-	-.31	.06	-.16***	-	-	-
School moves 8-12	-	-	-	-.40	.09	-.12***	-	-	-
1 school move	-	-	-	-	-	-	-.20	.12	-.06
2 school moves	-	-	-	-	-	-	-.56	.14	-.13***
3 school moves	-	-	-	-	-	-	-.82	.17	-.15***
4 or more school moves	-	-	-	-	-	-	-.93	.16	-.18***
Residential moves k-12	-.20	.08	-.07*	-.23	.08	-.08**			
Step Two:									
School moves k-12	-.09	.03	-.08**	-	-	-	-	-	-
School moves k-4	-	-	-	.03	.06	-.02	-	-	-
School moves 4-8	-	-	-	-.14	.06	-.07*	-	-	-
School moves 8-12	-	-	-	-.25	.09	-.07**	-	-	-
1 school move	-	-	-	-	-	-	.08	.12	.02
2 school moves	-	-	-	-	-	-	-.17	.14	-.04
3 school moves	-	-	-	-	-	-	-.25	.17	-.05*
4 or more school moves	-	-	-	-	-	-	-.32	.17	-.06*
Residential moves k-12	-.11	.08	-.04	-.13	.08	-.05	-.10	.08	-.04
Controls	-	-	-	-	-	-	-	-	-
Step Three:									
School moves k-12	-.06	.03	-.05	-	-	-	-	-	-
School moves k-4	-	-	-	.03	.05	.01	-	-	-
School moves 4-8	-	-	-	-.10	.06	-.05	-	-	-
School moves 8-12	-	-	-	-.18	.09	-.05*	-	-	-
1 school move	-	-	-	-	-	-	.08	.11	.02
2 school moves	-	-	-	-	-	-	-.15	.13	-.04
3 school moves	-	-	-	-	-	-	-.21	.16	-.04
4 or more school moves	-	-	-	-	-	-	-.20	.16	-.04
Residential moves k-12	-.12	.07	-.05	-.14	.07	-.05	-.12	.07	-.04
Controls	-	-	-	-	-	-	-	-	-
8th grade reading	.02	.00	.24***	.02	.00	.24***	.02	.00	.24***
Juvenile delinquency	-.61	.12	-.14***	-.61	.12	-.14***	-.61	.12	-.14***

*p < .05, **p < .01, ***p < .001.

Appendix D. Unadjusted Means of School Mobility by Program Intervention

Variables	Any CPC preschool vs. none						Any follow-on vs. none						Extended group					
	Comparison group			Any CPC preschool			Comparison group			Any follow-on			Comparison group			Any extended		
	n	mean	sd	n	mean	sd	n	mean	sd	n	mean	sd	n	Mean	sd	n	mean	sd
School mobility K-8 (n=1,410)																		
Number of moves	498	1.55	1.40	912	1.22	1.30	592	1.78	1.41	818	1.02	1.20	862	1.74	1.40	548	.71	.96
1 or more school moves	498	.76	.43	912	.64	.48	592	.84	.37	818	.57	.50	862	.82	.38	548	.47	.50
2 or more school moves	498	.42	.49	912	.32	.47	592	.48	.50	818	.26	.44	862	.48	.50	548	.16	.37
3 or more school moves	498	.22	.41	912	.15	.36	592	.26	.44	818	.12	.32	862	.25	.43	548	.05	.23
4 or more school moves	498	.10	.31	912	.07	.26	592	.13	.34	818	.05	.22	862	.12	.33	548	.02	.15
School mobility 4-8 (n=1,361)																		
Number of moves	473	1.20	1.07	888	.84	.92	566	1.16	1.04	795	.83	.93	827	1.14	1.04	534	.69	.84
1 or more school moves	473	.70	.46	888	.56	.50	566	.70	.46	795	.54	.50	827	.68	.47	534	.49	.50
2 or more school moves	473	.34	.47	888	.21	.41	566	.31	.46	795	.22	.41	827	.32	.47	534	.16	.37
School mobility 4-12 (n=1,265)																		
Number of moves	439	1.80	1.22	826	1.54	1.08	527	1.83	1.17	738	1.49	1.09	765	1.80	1.19	500	1.38	1.00
1 or more school moves	439	.90	.31	826	.88	.32	527	.92	.27	738	.86	.35	765	.91	.29	500	.85	.36
2 or more school moves	439	.53	.50	826	.42	.49	527	.54	.50	738	.40	.49	765	.53	.50	500	.36	.48
3 or more school moves	439	.23	.42	826	.16	.37	527	.24	.43	738	.15	.36	765	.23	.42	500	.12	.33
4 or more school moves	439	.09	.29	826	.06	.24	527	.09	.28	738	.06	.24	765	.09	.29	500	.04	.20

Appendix E. Estimated Program Effects for School Mobility, Grades 4 –12

		School mobility 4-12 (N=1,265)														
		Number of school moves			1 or more school moves			2 or more school moves			3 or more school moves			4 or more school moves		
Model	Marginal effects	Unadj. Mean diff.	Adj. mean diff.	Adj. mean diff with attrit.	Unadj. Mean diff.	Adj. mean diff.	Adj. mean diff with attrit.	Unadj. Mean diff.	Adj. mean diff.	Adj. mean diff with attrit.	Unadj. Mean diff.	Adj. mean diff.	Adj. mean diff.	Unadj. Mean diff.	Adj. mean diff.	Adj. mean diff. with attrit.
1-1	Preschool participation	-.252***	-.113	-.108	-.014	.015	.016	-.114***	-.068+	-.066+	-.070 **	-.039*	-.040*	-.028 +	-.019	-.018
1-2	School-age participation	-.341***	-.298***	-.326***	-.062***	-.068**	-.077***	-.144***	-.123***	-.134***	-.085***	-.0720*	-.072*	-.024 +	-.017	-.018
	Preschool participation	-.252***	-.086	-.083	-.014	.019	.019	-.114***	-.058	-.057	-.070 **	-.0322	-.032 +	-.028 +	-.0132	-.013
	School-age participation	-.341***	-.281***	-.307	-.062***	-.065**	-.074***	-.144***	-.116***	-.126	-.085***	-.0671*	-.066 *	-.024 +	-.0141	-.014
2-1	Extended participation	-.417***	-.392***	-.407***	-.056**	-.054**	-.059**	-.169***	-.169***	-.174***	-.111***	-.107***	-.106***	-.051***	-.046***	-.046***
2-2	Extended participation	-.417***	-.360***	-.375***	-.056**	-.048*	-.050*	-.169***	-.156***	-.162***	-.111***	-.099***	-.098***	-.051***	-.041***	-.041***

Notes:

1. Unadj. =Unadjusted; Adj. = Adjusted. * p<.05, ** p<.01, *** p<.001. Coefficients are from ordered probit and probit regressions transformed to marginal effects.
2. Model 1-1 included preschool or school-age participation, sex of child, race/ethnicity, residence in high-poverty school, single-parent status, teen parenthood, mother was not a high school graduate, 3 or more children in family, public aid receipt, eligible for fully subsidized meals, and parent not employed.
   Model 1-2 includes kindergarten word analysis from the Iowa Tests of Basic Skills to previous model.
   The attrition correction model includes a propensity score of being in the school mobility sample. This propensity score was calculated using probit regression given a subset of covariates including preschool or school-age participation, sex of child, race/ethnicity, number of family risk (ages 0-3), any missing data, kindergarten word analysis, home environment risk, have social security number, percentage of people who live one year or less in the current housing unite, and percentage of people who work as labors.
3. Model 2-1 included extended participation, sex of child, race/ethnicity, residence in high-poverty school, single-parent status, teen parenthood, mother was not a high school graduate, 3 or more children in family, public aid receipt, eligible for fully subsidized meals, and parent not employed.
   Model 2-2 includes kindergarten word analysis from the Iowa Tests of Basic Skills to previous model. For the three outcomes, kindergarten word analysis is significant.
   The attrition correction model includes a propensity score of being in the school mobility sample. This propensity score was calculated using probit regression given a subset of covariates including preschool or school-age participation, sex of child, race/ethnicity, number of family risk (ages 0-3), any missing data, kindergarten word analysis, home environment risk, have social security number, percentage of people who live one year or less in the current housing unite, and percentage of people who work as labors

Appendix F. Probit Regressions Predicting Any School Moves and 3 or More School Moves, gradesK-8 (n=1,360)

	dF/dx, Any school moves, grades K-8						dF/dx, Three or more school moves, grades K-8					
	Model 1		Model 2		Model 3		Model 1		Model 2		Model 3	
Any CPC preschool	.031		.054	+	.054		.000		.018		.021	
Any CPC follow-on	-.291	***	-.287	***	-.287	***	-.121	***	-.114	***	-.118	***
Female	-.076	**	-.070	**	-.074	**	.015		.020		.035	+
Black	.110	*	.142	*	.143	*	.024		.044		.040	
Single mother	-.049		-.050		-.049		-.015		-.018		-.015	
Mother's age	.082	*	.080	*	.082		.055	*	.051	+	.050	+
Mother did not complete HS	.036		.032		.034		.018		.018		.015	
Mother had some college	-.096	*	-.082	+	-.081	+	-.036		-.024		-.023	
More than 4 children in the HH	.010		.012		.016		-.040		-.037		-.032	
TANF	.030		.024		.026		.010		.005		.013	
Mother is not employed	.108	**	.104	**	.106	**	.028		.022		.015	
School lunch eligibility	.011		.004		.002		.080	**	.079	**	.074	**
School neighborhood poverty	.102	***	.110	***	.108	***	-.044	+	-.035		-.032	
Missing risk factors	-.036		-.024		-.023		-.031		-.020		-.019	
Child abuse & neglect, 0-3	-.105		-.119		-.075		-.016		-.024		-.021	
Negative home environment index	.034		.035		.033		.030		.029		.028	
Residential mobility, grades K-12	.116	***	.117	***	.116	***	.142	***	.142	***	.140	***
Missing residential mobility	-.176	***	-.195	***	-.187	***	-.082	**	-.088	***	-.089	***
% Blacks who are HS graduates, census data	1.007	***	1.009	***	.996	***	-.105		-.079		-.060	
% people working in the private sector, census data	.309		.357		.345		-.332	+	-.268		-.264	
Cognitive composite, start of K			-.005	**	-.005	**			-.005	***	-.005	***
Word analysis score, end of K			.000		-.001				.000		.000	
Math score, end of K					.000						.002	+
Socio-emotional maturity, grade 1					.002						-.005	**
Pseudo R2	.166		.173		.1732		.1661		.1804		.187	

Note: + p<0.10, * p<0.05, ** p<0.01, *** p<0.001.

Appendix G. Probit Regressions Predicting Any School Moves and 3 or More School Moves, Grades K-8 (n=1,360)

	dF/dx, Any school moves, grades K-8						dF/dx, 3 or more school moves, grades K-8					
	Model 1		Model 2		Model 3		Model 1		Model 2		Model 3	
Any CPC preschool	-.105	***	-.075	**	-.075	**	-.040	*	-.015		-.013	
Female	-.064	*	-.057	*	-.062	*	.019		.025		.039	*
Black	.065		.097	+	.099	+	.018		.040		.035	
Single mother	-.037		-.037		-.038		-.011		-.013		-.011	
Mother's age	.082	*	.079	*	.081	*	.051	+	.049	+	.048	+
Mother did not complete HS	.038		.033		.034		.025		.024		.021	
Mother had some college	-.097	*	-.080	+	-.080	+	-.032		-.019		-.017	
More than 4 children in the HH	.017		.018		.021		-.044	+	-.041		-.036	
TANF	.013		.007		.008		.003		-.003		.005	
Mother is not employed	.108	**	.104	**	.107	**	.030		.023		.017	
School lunch eligibility	.014		.005		.003		.084	**	.083	**	.079	**
School neighborhood poverty	.096	**	.100	***	.097	**	-.042	+	-.034		-.032	
Missing risk factors	-.031		-.018		-.016		-.024		-.013		-.011	
Child abuse & neglect, 0-3	-.072		-.081		-.043		-.015		-.022		-.018	
Negative home environment index	.033		.033		.032		.028		.027		.026	
Residential mobility, grades K-12	.115	***	.117	***	.116	***	.148	***	.147	***	.146	***
Missing residential mobility	-.182	***	-.205	***	-.197	***	-.090	***	-.097	***	-.098	***
% Blacks who are HS graduates, census data	1.004	***	1.040	***	1.026	***	-.115		-.087		-.066	
% people working in the private sector, census data	-.016		.039		.027		-.518	***	-.449	*	-.450	*
Cognitive composite, start of K			-.005	**	-.005	*			-.005	***	-.005	***
Word analysis score, end of K			-.002		-.002				-.001		-.001	
Math score, end of K					-.001						.001	+
Socio-emotional maturity, grade 1					.003						-.005	*
Pseudo R2	.1024		.1126		.113		.139		.1557		.1605	

Note: + p<0.10, * p<0.05, ** p<0.01, *** p<0.001. Residential mobility (1=0 moves, 2=1-2 moves, 3=3+ moves). This model did not control for CPC follow-on participation.

Appendix H. CLS Mediator studies

Outcome variables	References
Reading & math (grade 1)	Reynolds, A. J. (1989). A structural model of first-grade out-comes for an urban, low socioeconomic status, minority population. *Journal of Educational Psychology, 81,* 594- 603.
	Reynolds, A.J., 1991. Early schooling of children at risk. *American Educational Research Journal, 28,* 392–422.
Reading & math (grade 1& 2)	Reynolds, A. J. (1991). Early schooling of children at risk. *American Educational Research Journal, 28,* 392- 422.
	Walberg, H. J., & Reynolds, A. J. (1992). research-based theory for educational planning and evaluation.
Reading & math (grade 3)	Reynolds, A. J. (1992). Mediated effects of preschool intervention. *Early Education and Development, 3,* 139 – 164.
Reading & math (grade 6)	Reynolds, A. J. (1998). Confirmatory program evaluation: A method for strengthening causal inference. *American Journal of Evaluation, 19,* 203-221.
School achievement (age 14)	Reynolds, A. J. (2004). Dosage-response effects and mechanisms of change in public and model programs. In E. Zigler & S. J. Styfco (Eds.), *The Head Start debates* (pp.379-396). Baltimore, MD: Paul H. Brookes Publishing Co.
Reading & math (grades 8, age 15)	Reynolds, A. J. (1996). Long-term effects of the Chicago Child –Parent Center Program up to age 15.
Educational attainment by age 20	Reynolds, A. J., Ou, S., & Topitzes, J. D. (2004). Paths of effects of early childhood intervention on educational attainment and delinquency: A confirmatory analysis of the Chicago Child–Parent centers. *Child Development, 75,* 1299–1328.
	Reynolds, A.J., & Ou S. (2003).Promoting resilience through early childhood intervention. in S.S. Luthar (ed.), Resilience and Vulnerability: Adaptation in the Context of Childhood Adversities (Cambridge University Press, New York), pp. 436–459.
	Reynolds, A. J. (2004). Research on early childhood interventions in the confirmatory mode. *Children and Youth Services Review, 26,* 15–38.
	Reynolds, A. J. (2004). Dosage-response effects and mechanisms of change in public and model programs. In E. Zigler & S. J. Styfco (Eds.), The Head Start debates (pp.379-396). Baltimore, MD: Paul H. Brookes Publishing Co.
Educational attainment at age 22	Ou, S. (2005). Pathways of long-term effects of an early intervention program on educational attainment: Findings from the Chicago longitudinal study. *Journal of Applied Developmental Psychology, 26,* 578-611.