

# LONG-TERM FOLLOWUP OF CHILD DEVELOPMENT PROGRAMS IN ALBUQUERQUE, PHASE II

Report submitted to the City of Albuquerque

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## **EXECUTIVE SUMMARY**

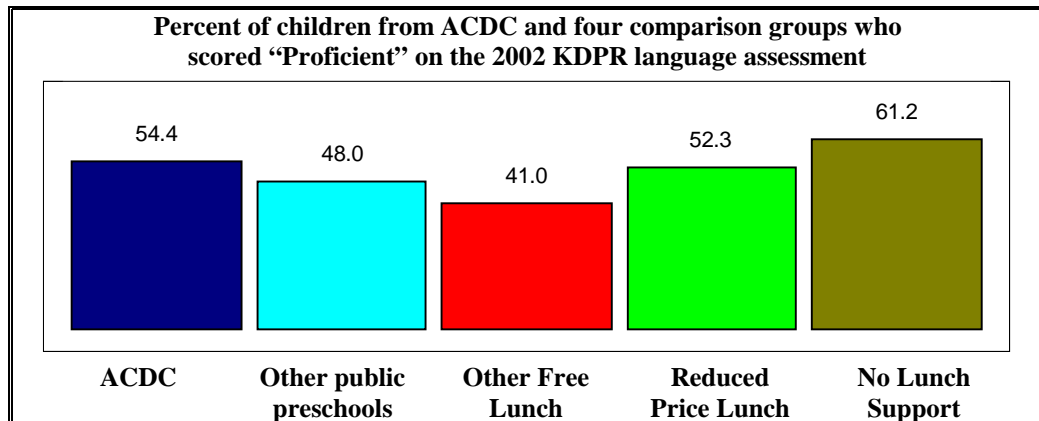
In April 2001 the Institute for Social Research reported the first phase of a study conducted for the City of Albuquerque to assess the effectiveness of public preschool programs, particularly the City's own program, Albuquerque Child Development Centers (ACDC). With the cooperation of Albuquerque Public Schools, children who had attended a preschool and were enrolled in APS grades 1-6 during Spring 2000 were identified, a comparison group was selected, and the school records of both groups analyzed. The present, Phase 2 research, has two purposes: First, to follow the children from Phase 1 through two additional years of APS, and second, to begin tracking three new cohorts—children who entered APS kindergarten in the school years 1999-2000, 2000-2001, and 2001-2002.

The essential finding of Phase 1 was that for grades 1-3 the preschool and comparison group children had closely similar reading achievement scores and rates of placement in special education, but the preschool children in grades 4-6 were significantly less likely than the comparison children to be placed in special education. The Terra Nova reading scores of preschool children were also higher than those of comparison children. These two findings go together: children in special education do not, on average, perform as well as other children on achievement tests, so as more comparison children were placed in special education, average reading scores for the comparison group declined. At the same time, the percentages of preschool children in special education in grades 4-6 did *not* increase, and their reading scores stayed level or improved slightly in higher grades. The first task of the Phase 2 study, therefore, was to track the grade 1-6 cohorts from Spring 2000 through Spring 2002 and see if increasing numbers of comparison group, relative to preschool, children were placed in special education (particularly from grade 4 on).

While nothing in the Phase 2 study contradicted the Phase 1 pattern, an important modification emerged. While Phase 1 found a sharp difference between grades 3 and 4 in special education placement, tracking each cohort for two more years made it clear that the effects are much more gradual. The trend was for comparison children from grade 1 on to be placed in special education more frequently than preschool children, at an annual rate of approximately two percent. By fifth grade that would mean that the rate at which comparison children were placed in special education would be at least ten percentage points higher than for preschool children (since the cohorts were tracked only for two years, the ten percent figure is an extrapolation, but it is consistent with other findings). Therefore, the Phase 2 conclusion is that the children who attended ACDC during the 1990's experience the long-term, delayed effect of successfully staying in mainstream classroom education and not requiring special education programs.

The second task was to begin tracking children entering kindergarten in 1999-2000, 2000-2001, and 2001-2002. Whereas Phase 1 found no differences between preschool and comparison children on reading and math performance in grades 1 and 2, Phase 2 finds slight advantages for ACDC children in the 1999-2000 cohort, and large and significant advantages for ACDC children in the 2000-2001 and 2001-2002 cohorts. This pattern suggests a gradual but successful improvement in cognitive

development components of the ACDC program. Scores for ACDC children on the language portion of the Kindergarten Developmental Progress Record (KDPR) are shown in the figure below, along with children from other public preschool programs, and three groups of children who did not attend a public preschool (including ACDC): Children receiving Free Lunch support, children receiving Reduced Price lunch support (family incomes between 130 and 185 percent of the federal poverty index), and children not receiving any lunch support.



More ACDC children scoring "Proficient" on this assessment (54.4 percent) than children from other public preschools (48.0 percent), who in turn scored better than non-preschool children receiving Free Lunch support (41.0 percent). Furthermore, ACDC children scored slightly higher than non-preschool children receiving Reduced Price lunch support (52.3 percent). In fact, ACDC children in 2002 scored "Proficient" at a rate only seven-percentage points below the highest income non-preschool group, children receiving no lunch support at all. Since the purpose of public preschools is to help children from low-income families enter kindergarten on the same level with children from middle-class families, ACDC appears to be doing its job quite well.

What accounts for the apparent contributions to language development (and also math) of attending ACDC or another public preschool program? The first question to ask is whether the kinds of families that send their children to preschools are different from those who do not. For example, they may be more concerned about helping their children to do well in school; research shows that children from families with strong concerns about their education are more likely to succeed. The best answer here is that parents who sent their children to ACDC were probably not more concerned about helping their children succeed in school than those who sent their children to other preschools. So the superior performance of ACDC children relative to children from other public preschools appears well grounded. However, the superior performance of the other preschool children relative to non-preschool children could reflect differences in parents' motivations.

To explore these questions in more detail, a multivariate analysis was carried out which looked at more specific categories of pre-kindergarten experience, family income as reflected in lunch support status, and several other variables. Two major findings emerged from this analysis:

1. The higher language scores of ACDC children relative to other preschool children in kindergarten are partially accounted for by the fact that ACDC children come from families with slightly higher incomes than, for example, Head Start children. However, the remaining, substantial, advantage of ACDC children relative to children from other preschools is not reduced when the effects of special education, English proficiency, and

Hispanic ethnicity on language achievement scores are statistically controlled. This implies that the positive advantages of attending ACDC contribute directly to developing the cognitive abilities that the kindergarten language tests assess.

2. Children from other public preschools have higher language scores than children who did not attend a preschool. This appears to be partially explained by the superior English proficiency of preschool children when they arrive in kindergarten. English proficiency, in fact, appears to be more important than Hispanic ethnicity—when both are controlled statistically, the effects of Hispanic ethnicity almost disappear. Furthermore, English proficiency is strongly related not only to the KDPR language assessment (which is given in both Spanish and English versions), but also to superior performance on the KDPR math assessment.

Most importantly, then, this study found that the Albuquerque Child Development Centers program is doing a good job of preparing children from low-income families to enter kindergarten at a level of development equal to children from families with higher incomes. This shows steady progress: ACDC has made strong advances in the development of language and math skills during the past few years. The next phase of the research will concentrate on identifying and evaluating the features and components of the program that make the greatest contributions to improving these outcomes for the children.

It will also be important to learn why children from ACDC and other preschools arrive in kindergarten considerably more likely to be proficient in English than children who did not attend a preschool. The evidence shows that difficulties with English work against a child all the way through public school. Preschool programs appear to be effective preparing children for English competency, and thus make an important contribution. The next phase of the research will be designed to find out just how this works, and which approaches and program components are most effective in accomplishing it.

# TABLE OF CONTENTS

INTRODUCTION	1
Review of Findings from the Phase 1 Study	1
Review of Methodological Problems and Limitations in the Phase 1 Study	2
Alternative Procedures for Selecting Comparison Groups	3
I. TRACKING THE PHASE 1 COHORTS THROUGH TWO ADDITIONAL YEARS	6
Comparing Comparison Groups	6
Special Education	8
School Success	10
English Proficiency	11
Reading Achievement	13
II. CHILDREN ENTERING APS KINDERGARTEN 1999-2000, 2000-2001, 2001-2002	15
Comparison Groups	15
Demographics	16
Achievement test scores	17
Extending the Range of Comparison Groups to All Combinations of Pre-Kindergarten Experience and Free Lunch Status	20
Multivariate Analysis of KDPR Proficiency	24
Special Education, Grade Retention and School Success	26
English Proficiency	27
Multivariate analysis of KDPR Proficiency with School Success, English Proficiency, and Ethnicity introduced as possible mediating variables	29
Analysis of Data on Children's Backgrounds and Experiences in Preschool	32
III. SUMMARY AND CONCLUSIONS	36

## LIST OF TABLES

Table 1.1. Comparison of alternative comparison groups on percentage of students placed in Special Education.	7
Table 1.2. Percentage of students placed in Special Education Spring of 2000, 2001, and 2002, for preschool programs and for all other students in the Free Lunch program.	9
Table 1.3. Lack of school success by 2002 (numbers indicate percentage of the grade 1 cohort who were either in special education or retained in grade by 2002).	11
Table 1.4. Percent of students with Full English Proficiency, for preschool programs and students in the Free Lunch comparison group, from Spring 2000 to Spring 2002.	12
Table 1.5. Percent of all APS students with full, limited, or no English proficiency during Spring 2000, 2001, and 2002 who were in Special Education that year, by grade in 2000.	13
Table 1.6. Mean reading achievement scores for preschool programs and students in Free Lunch program (Developmental Reading Index scores for grades one and two, Terra Nova scores from grade 3 on).	14
Table 2.1. Sex distribution of preschool and comparison groups in Cohort 2000 (1999-2000), Cohort 2001 (2000-2001), and Cohort 2002 (2001-2002).	16
Table 2.2. Ethnicity of preschool and comparison group children in each cohort.	16
Table 2.3. Percentages of children entering APS kindergarten in Cohorts 2000, 2001, and 2002 who scored "Proficient" on the KDPR and Grade 1 Reading Assessments, and Grade 2 Reading Assessments for Cohort 2002. Different versions of the KDPR were used during different years. No grade 1 reading assessment was given in school year 2001-2002.	17
Table 2.4. Percent of Cohort 2002 children with each type of pre-kindergarten experience who were in the Free Lunch, Reduced Price, or no lunch support program.	22
Table 2.5. Percent of Cohort 2001 and 2002 children who are proficient on the KDPR, by lunch support status and type of pre-kindergarten experience. Confidence intervals at the .05 level for ACDC percentages shown in parentheses.	23
Table 2.6. Logistic regression analysis estimating the effects of ACDC, Preschool, and Lunch Support status on proficiency (vs. non-proficiency) on the 2001 and the 2002 KDPR.	25
Table 2.7. Lack of School Success: Percent of children entering APS kindergarten in Cohorts 2000, 2001, and 2002 who were in Special Education during Spring 2000, 2001, and 2002, retained in grade at some time, and were either in special education or retained in grade by Spring 2002.	26

Table 2.8. For children receiving Free Lunch support only, percentage of Cohort 2001 pre-kindergarten groups retained in grade by 2002.	27
Table 2.9. Percent of children entering APS kindergarten in Cohorts 2000, 2001, and 2002 with full English proficiency during Spring of 2000, 2001, 2002.	27
Table 2.10. For children on Free Lunch only, percent of each pre-kindergarten group Proficient in English during 2001 and 2002.	28
Table 2.11. Percent of children with full English proficiency in APS kindergarten and first grade, by primary language spoken on entering preschool, for ACDC and Head Start children.	29
Table 2.12. Logistic regression analysis estimating the effects of ACDC, Preschool, and Lunch Support status on proficiency (vs. non-proficiency) on the 2001 and 2002 KDPR.	30
Table 2.13. Percent of children with different levels of exposure to Head Start who were a) in Special Education during Spring 2000, 2001, or 2002, b) retained in grade at some time, and c) <i>either</i> in special education <i>or</i> retained in grade ("Problems with school success") by 2002.	33
Table 2.14. Percent of Head Start children entering APS kindergarten in Cohorts 2000, 2001, and 2002 who scored "Proficient" on the KDPR and Grade 1 Reading Assessments, and Grade 2 Reading Assessments for Cohort 2002. Different versions of the KDPR were used during different years. No grade 1 reading assessment was given Spring 2002.	34
Table 2.15. Parents' education by percent of Head Start children entering APS kindergarten in Cohorts 2001 and 2002 who scored "Proficient" on the KDPR .	34
Table 2.16. Household income by mean scores for Head Start children in APS kindergarten. KDPR total for cohort entering during 2000-2002, and language and math subscales for children entering 2001-2002.	35

# INTRODUCTION

In April 2001 the Institute for Social Research reported the first phase of a study conducted for the City of Albuquerque to assess the effectiveness of public preschool programs operating in Albuquerque during the 1990's. The research began with lists of children who had been enrolled in the three programs between 1990 and 1997: City of Albuquerque Child Development Centers (ACDC), Albuquerque Public Schools (APS) Even Start program, and Youth Development Inc. (YDI)-Head Start. With the cooperation of Albuquerque Public Schools children from these lists who were enrolled in APS during Spring 2000 were identified and their school records analyzed. The present study has two purposes: First, to follow the children from phase 1 through two more years of APS, and second, to begin tracking three new cohorts—children entering APS kindergarten in the school years 1999-2000, 2000-2001, and 2001-2002.

## **Review of Findings from the Phase 1 Study**

The effects of preschool experience were analyzed by comparing children who had attended a preschool with another group of children who according to the records did not attend preschool but were selected to be as similar as possible to the preschool group. Because eligibility for preschool programs is restricted to children from low-income families, the phase 1 study randomly selected a matched comparison group of children who were in the same grades at the same schools as the preschool group and were receiving support from the federal Free Lunch program (families with incomes less than 130 percent of poverty are eligible). Choosing a comparison group after the fact (when the children are already in APS rather than when they were three years old and ready to begin preschool) is always a tricky process. If a comparison group is not truly equivalent, this can introduce biases that predispose the preschool groups to look either better or worse than they really are, depending on the nature of the biases. As the current, Phase 2 study will reveal, there are reasons for thinking that the matched comparison group used in Phase 1 distorted the findings somewhat, although not enough to change the substantive conclusions significantly.

When the preschool children were compared with this matched comparison group, some important long-term effects were indicated:

- While there were essentially no differences in reading assessment scores between the preschool and comparison samples for children in grades 1-3, starting with grade 4 the Terra Nova reading composite scores of children who had attended preschool were higher than those of the comparison group children.
- The differences widened and were statistically significant from grade 4 through grade 6. In terms of national standards, the scores of preschool children averaged at about the 41<sup>st</sup> percentile for grades 3 through 6. The average scores of comparison children in grade 3 were at about the same level as the preschool children, but in grades 4-6 they declined steadily, reaching the 25<sup>th</sup> percentile for sixth graders.
- At the same time, and with an almost identical pattern, comparison children in grades 4-6 (but not grades 1-3) had been placed in special education at significantly higher rates.
- After extensive statistical analysis, it was concluded that the less frequent placement of preschool students in special education offered a partial but substantial and consistent explanation for their higher reading scores. Children are placed in special education because, for a variety of reasons, they are not fitting in and progressing with mainstream classroom

education. Special education programs attempt to counteract this tendency, but they are only partially successful. Placement in special education by the middle elementary years (roughly, grades 3-5), therefore indicates that the child is not fitting in with the mainstream flow.

These findings were important because they suggested that something about the preschool experience was associated with more positive outcomes for children later on—but in Phase 1 these outcomes only began to show up in grade 4. The core finding was that preschool children were less likely to be placed in special education from grade 4 on. This was interpreted to mean that the preschool experience somehow made it easier for the child to stay in the mainstream of classroom education all through elementary school, and hence to avoid being placed (for any of a multitude of reasons) in special education. Children who stay in the mainstream of classroom education are more likely to learn what is taught in the classroom, in particular to keep up with reading and math development. They therefore tend to score better on the Terra Nova.

### **Review of Methodological Problems and Limitations in the Phase 1 Study**

1. Limited longitudinal data. One limitation of the phase 1 study was that the key data sets available for analysis were restricted to Spring 2000. This meant that we were looking at completely different groups of children in, for example, grade 3 and grade 4. When we found differences between the children in grades 3 and 4, we could not tell whether this was something characteristic of the school grade, or whether the differences between grades 3 and 4 went back to differences between the two groups of children that already existed when they were in grade 1 or kindergarten. In the latter case, we would just have been dealing with two groups of children who had “always” been different from each other. Because so much rested on the difference between the children in grades 3 and 4, a special effort was made to obtain data that allowed tracking the children who were in grade 3 in Spring 2000 (when the preschool and comparison children had the same rates of special education placement) as they progressed into grade 4 the following fall. These data, for December 2000, indicated that indeed a difference between the two groups had begun to open up, with preschool children a few percentage points less likely than comparison children to have been placed in special education.

This snippet of longitudinal analysis supported the findings obtained from the static comparisons between grades 3 and 4, and provided a basis for hypothesizing that events begin to happen in grade 4 that show up as increasing differences in rates of special education placement between preschool and comparison group children. However, the Phase 1 report emphasized that the analysis was still limited to a short period of time, and concluded by saying that “it would be unwise to make too much of the present findings” until longitudinal data covering a longer time period are available. In the Phase 2 analyses two full years of data are available, which provides a much stronger position for tracking change over time in the same cohorts of children.

2. Comparison group problems. From a scientific perspective, the ideal method for selecting a comparison group would start with the pool of all three-year olds whose parents apply to enroll them in preschool, then randomly assign half of these children to enter preschool and tell the other half to go back home and serve as the control group. This procedure has actually been used to evaluate some small, privately funded, experimental programs, but it is obviously inappropriate (not to mention immoral) for large-scale public programs.

The remaining options all involve strategies that replace random assignment with some natural process that approximates the desired result: Select comparison children who are as similar as possible to the children who attend preschool. Two criteria are particularly important for assessing “degree of similarity”.

1. Families who enroll their children in preschool may be more concerned about their child’s education, and more motivated to take advantage of help that is available through preschool programs, than families who do not. An ideal selection strategy would therefore identify children of families who had demonstrated this motivation by attempting to enroll their children in preschool, but were unsuccessful because, e.g., there were not enough positions available to admit all applicants. It is important that the basis for rejection not introduce any biases (for example, if the family for various reasons did not follow through on the application, this would be a serious source of bias because these families are very likely different in important respects from families whose children enrolled and attended throughout the school year).
2. There is strong and consistent evidence that children from lower income families do not fare as well in school as children from middle income families—that is the whole rationale behind spending public moneys to support preschool education for low-income children. An ideal selection strategy would therefore identify comparison children whose families had the same incomes as preschool children *at the time the children entered preschool* (typically, when they were three years old).

There are a number of procedures available that *approximate* these two “ideal strategies”, but none (that we have been able to find) that fully realize the ideal. Because the procedure used to select comparison groups is so important, and because there are so many imperfect candidates to choose from, the remainder of this section will be spent discussing the pro’s and con’s of each possible comparison group in detail. A satisfactory research report cannot avoid grappling with the technical details involved in comparison group selection, but the reader who is more interested in findings than methodologies may wish to move ahead to Section I.

### **Alternative Procedures for Selecting Comparison Groups**

1. Matching by school and grade. In Phase 1, the comparison group was selected by first identifying all children who were in the same grades at the same schools as the children in the preschool group, and had been on the federal Free Lunch program. From each grade- and school-specific list, a number of children proportional to the number of preschool children in that grade of that school were randomly picked. This procedure satisfies the low-income requirement outlined above by restricting the comparison group to children on the Free Lunch program (although the income-equivalence is only approximate and improvements will be explored shortly). By weighting selection of the comparison group proportional to the number of preschool children in each school and grade, variations in characteristics of the neighborhood are controlled, which is desirable but probably not as important as the two listed above. The second requirement, that variation in the motivation of parents to further the education of their children be controlled, is completely ignored in this selection process. Therefore, the matched comparison group selected for phase 1 was less than ideal.
2. A strategy that seems to meet the two equivalence criteria would identify children who applied for admission, met the income-eligibility requirements, but were not admitted due to insufficient openings in the program. This information is currently available from Head Start, and will be provided by ACDC. Unfortunately (for researchers, not for the children and their families), most of

the children not admitted on the first try are three-year olds, who are then given priority for admission as four-year olds. In fact, therefore, there are almost no eligible and motivated applicants who never attend Head Start, eventually. The same seems to be true for ACDC. One use of this procedure would be to compare children who attend one year of preschool with children who attend two years—but that is a specialized application, and in fact some data relevant to it will be reported in Tables 2.13 and 2.14.

Realistically, there is no available method for selecting a comparison group based on data collected when the children are three or four years old. By default, therefore, selection must begin with the pool of all children who enroll each year in kindergarten at Albuquerque Public Schools, mostly five-year olds. APS data for kindergartners apply to both family income and parents' motivation. Both of these data sources have limitations, and it is necessary to discuss each at some length.

Free or Reduced Price Lunch Program (FRPL). Family income determines whether students are eligible for FRPL, but the cutting points match up only approximately with eligibility requirements for the preschool programs. *Free Lunch* support is restricted to families whose total household income is no more than 130 percent of the federal poverty index. ACDC and Even Start admit families with income up to 175 percent of the poverty line, while Head Start is limited to families with total income no more than 100 percent of poverty (*except that* it is required by federal mandate that ten percent of the children enrolled in Head Start programs have disabilities, and the families of disabled children do not need to meet the income requirement). Restricting the comparison group to children receiving Free Lunch support therefore misses some of the ACDC and Even Start children, but includes some families with incomes higher than those required by Head Start. *Reduced Price support* is for families with incomes between 130 and 185 percent of poverty. This means that ACDC and Even Start children with family incomes between 130 and 175 percent of poverty are eligible for Reduced Price lunches, but no Head Start children would be included. Comparison group children selected from among those receiving Reduced Price support would, of course, include some children from families with incomes too high to qualify for the preschool programs (175-185 percent of poverty for ACDC and Even Start, 100-185 percent for Head Start). Since FRPL data are all we have to go by, selecting comparisons on the basis of these data will always be an imperfect process. FRPL data are much better than nothing, however, and by being clear on the limitations we can try to use the data judiciously.

There are some other problems with FRPL data. Eligibility for either lunch support program is first determined in kindergarten, which is one or two years after children begin preschool. Family income can vary over time, and the longer the time span the greater the likelihood of variation. For the Phase I cohorts the earliest information available on Free Lunch status was for 1998-1999, so while we could define the Free Lunch status of children who were first graders in 1999-2000 on the basis of whether they were in the program in kindergarten the previous year, the free lunch status of sixth graders had to be based on their fifth grade records. That is six or more years after the sixth graders were admitted to preschool, and is therefore only an approximate indicator of what family income was at the time the child was three years old.

Even when FRPL data are available at the time children enter kindergarten (as for the three kindergarten cohorts to be studied here), the lapse of one or two years can be crucial for evaluating program contributions. Changes in family income are important because all three preschool programs, and ACDC in particular, work with the family as well as the child (for example through home visitation) to encourage and support not only better parenting practices but also job training

and further education. These programs could cause incomes to increase more frequently among preschool families than comparison families. And of course, the incomes of some preschool and comparison families will decrease during that time. The result is a moving target—if we require that all families, both preschool and comparison, to have children on the Free Lunch program during kindergarten, then we eliminate the possible contribution of the preschool programs in helping their families improve financially by removing these families from the analysis. This is a conservative bias, because it rules out a potential contribution of preschool programs. If we leave the successful preschool families in the analysis but restrict comparison families to those whose children receive lunch support, then we are eliminating the comparison families whose incomes have improved and introducing a bias toward findings more positive than they really are. Again there is no perfect solution, but again there are strategies for using the data as effectively as possible. Later in Section III a multivariate analysis will deal with the problem statistically by including both the Free and Reduced Price categories simultaneously.

Pre-kindergarten experience. When families enroll their children with APS each year they have to fill out a form which, among other questions, asks, “What type of preschool did the child attend?” Four possible answers are provided: Did not attend preschool, Private preschool, Public preschool, and Head Start. If the parents said the child attended a preschool, this satisfies the motivational condition posed earlier (they wanted their child to be in preschool and enrolled them), but with a major disadvantage. Rather than children whose parents wanted them to attend a preschool but were unable to enroll them, we have children who benefited from an (unknown) preschool program, and therefore cannot be considered a “pure” or “untreated” example of what would happen in the presence of parental motivation but the absence of actual preschool experience. The bias here is in a strongly conservative direction—it would tend to underestimate differences between the preschool and comparison groups. An alternative is use the category “Did not attend preschool”, which has the opposite bias—the children have no preschool experience, but there is no way of knowing whether their parents had the same motivations as the parents of the preschool children. In the present study we will often use both of these comparison groups to define a range, one representing each bias, and see how ACDC children fit in between them.

All of these options are available for studying the three kindergarten cohorts, and this analysis will be reported in Section II. For the Phase 1 cohorts discussed in Section I (the children who were in grade 1-6 in Spring 2000) the possibilities are more constrained. In both sections, the framework developed here will guide the practical decisions made in selecting appropriate comparison groups.

## I. TRACKING THE PHASE 1 COHORTS THROUGH TWO ADDITIONAL YEARS

To complement the original data from Spring 2000, Albuquerque Public Schools made available data for Spring 2001 and 2002. Of the 1,155 children in the phase 1 preschool group, 1,088 (94 percent) were in the APS database one year later (2001), and 1,052 (91 percent) were in the Spring 2002 dataset.

### **Comparing Comparison Groups.**

The first task is to look more closely at the comparison group used in the first report—as noted earlier it is possible that the differences in outcomes between the preschool and comparison children were caused by peculiarities of the comparison group rather than positive effects of the preschool experience. Table 1.1 explores this by plotting special education rates from Spring 2000 to Spring 2002 for not only the original matched comparison group but for two alternative groups. One is composed of children who were both eligible for the free lunch program *and* whose parents reported that their child had attended a public preschool program before entering APS. This is the “Free Lunch+ Preschool” group in Table 1.1. The second is composed simply of all children receiving Free Lunch support. In terms of the two criteria set forth earlier for maximizing similarity between preschool and comparison groups, restricting a comparison group to children on the Free Lunch program ensures that they come from low income families, while the additional restriction that their parents say they attended a public preschool means that for both the preschool and comparison group the parents demonstrated a motivation to have their children attend preschool. Neither of these choices meet the criteria perfectly, however, as discussed earlier. The income eligibility requirements are higher for ACDC, and lower for Head Start, than the Free Lunch eligibility standards, and rather than selecting children for the comparison group who attended some other public preschool it would have been preferable to choose children who did not attend a preschool but whose parents wanted them to and/or attempted to enroll them.

As Table 1.1 shows, children in the matched comparison group have the lowest rates of placement in special education for children in grades 1-3 (as of Spring 2000), but the highest rates for children in grades 4-6. This is a dramatic reversal, and suggests that something peculiar about the matched comparison group could have contributed to the apparent superior performance of the preschool children in grades 4-6.

What might have gone wrong? It was impossible to check for errors directly, since the selection process was random, so we went through the whole process all over again, starting from scratch. This consisted of making a list of all the students in each grade of each school, and for each preschool student on that list randomly selecting (using a computerized random number generator) another student who was on the free lunch program. Replicating this process produced a second matched comparison group, which was then analyzed. However, this group showed the same features as the first group! In both matched comparison groups, children who were in grades 4-6 in Spring 2000 were more frequently in special education than either the “Free Lunch+Preschool” group or the “Free Lunch” group. Apparently errors in the selection process were not responsible for the peculiar features of the matched comparison groups. Just what was responsible, however, remains a mystery.

**Table 1.1. Comparison of alternative comparison groups on percentage of students placed in Special Education**

Spring 2000:	2000	2001	2002	N	
<i>First grade:</i>					
Free Lunch-eligible	10.6	14.3	18.2	1766	
Matched comparison	9.0	11.5	14.8	412	
Free Lunch+Preschool	10.3	12.4	16.1	299	
<i>Second grade:</i>					
Free Lunch	17.7	19.9	23.9	997	
Matched comparison	14.7	16.8	20.7	711	
Free Lunch+Preschool	17.1	21.0	24.4	176	
<i>Third grade:</i>					
Free Lunch	20.4	22.8	21.7	1656	
Matched comparison	15.4	19.5	19.1	329	
Free Lunch+Preschool	23.5	25.1	23.5	285	
<i>Fourth grade:</i>					
Free Lunch	22.5	23.7	23.8	1721	
Matched comparison	30.8	32.2	36.3	226	
Free Lunch+Preschool	27.7	30.4	30.5	187	
<i>Fifth grade:</i>					
Free Lunch	26.1	25.8	25.2	1868	
Matched comparison	36.7	37.3	37.2	172	
Free Lunch+Preschool	32.7	31.4	31.2	186	
<i>Sixth grade:</i>					
Free Lunch	25.1	25.1	24.2	1794	
Matched comparison	37.7	40.8	39.4	99	
Free Lunch+Preschool	25.5	24.7	23.5	149	

It seemed advisable, therefore, to not rely on either matched comparison group. This left a choice between the “Free Lunch+Preschool” and the “Free Lunch” groups. These two groups show similar, and relatively stable, rates of special education placement in Table 1.1. We chose to use the “Free Lunch” group in presentation, although both groups were tracked and no important differences between them were found in any of the subsequent analyses. The rationale for choosing the “Free Lunch-eligible” group as the primary comparison group is that Head Start was not managed by Youth Development Inc. until 1995, with the consequence that only the children in grades 1 and 2 during Spring 2000 had attended YDI-Head Start. This means that a large percentage of the children in grades 3-6 of the “Free Lunch+Preschool” group would very likely

have attended the pre-YDI version of Head Start. Head Start is a large program, and having these children in the comparison group for some grades (3-6) but not others (1-2) would produce a qualitative difference between the children in grades 1 and 2 and the children in grades 3-6 for that comparison group. Therefore, the “Free Lunch” group was chosen as the most conservative, and consistent, comparison group (it is also the largest, which contributes to stability by reducing random variation).

### **Special Education**

Table 1.2 examines the special education rates of each preschool group relative to the Free Lunch group. For the cohorts in grades 4-6, Spring 2000, the rates for ACDC children continue to be low, either remaining essentially stable or declining over the two year period. The same is true for the rather small numbers of Even Start children in the grade 4 and 5 cohorts. The advantages for the ACDC children in grades 4-6, relative to the Free Lunch group, are statistically significant.

ACDC and Even Start children also have lower rates of special education placement for grades 1 and 2, but the Head Start children show increasing rates of special education placement, slightly higher than rates for the Free Lunch comparison group.

According to the hypothesis suggested by the data in the Phase 1 report, the critical prediction is that special education rates for preschool and Free Lunch children in the grades 2 and 3 cohorts will diverge as these children enter grade 4, with comparison children increasingly likely to be placed in special education while the rates for preschool children remain steady or decline. There is some evidence of this in the grade 2 cohort, where the ACDC children move from special education rates essentially equal to the Free Lunch group in Spring 2000 to a 1½ percentage point advantage in 2001 and a 4½ percentage point advantage when they are in grade 4 in Spring 2002. For children in the grade 1 cohort a similar pattern emerges, with the ACDC children gradually opening up a five-point advantage over the Free Lunch group. For both the grades 1 and 2 cohorts, however, the tendency of ACDC children to be less often placed in special education is gradual and linear, rather than showing a quantum jump in rates between grades 3 and 4.

The grade 3 cohort, however, departs completely from the predicted pattern, with the special education rates for ACDC children staying parallel to the Free Lunch group between Spring 2000 and Spring 2001 but then increasing sharply, so that there is no difference between them in Spring 2002. Part of this departure from the Phase 1 report occurs because (see Table 1.1) the Free Lunch group in the grade 3 cohort starts out with higher special education rates than the matched comparison group did—so the apparent advantage of grade 3 ACDC children in Spring 2000 is just an artifact of switching comparison groups. Much more importantly, however, the grade 3 cohort of ACDC children proceeded, between Spring 2001 and Spring 2002, to get themselves placed in special education at a higher rate than either comparison group, the highest increase in placement of any ACDC grade cohort.

**Table 1.2. Percentage of students placed in Special Education Spring of 2000, 2001, and 2002, for preschool programs and for all other students in the Free Lunch program.**

Spring 2000:					
<i>First grade:</i>					
	2000	2001	2002	N	
ACDC	9.3	10.1	13.3	75	
Head Start	8.7	12.8	18.9	206	
Even Start	2.2	6.8	9.1	44	
Free Lunch	10.6	14.3	18.2	1766	
<i>Second grade:</i>					
ACDC	17.3	18.4	19.4	124	
Head Start	10.2	17.8	21.5	181	
Even Start	8.3	10.6	12.8	47	
Free Lunch	17.7	19.9	23.9	997	
<i>Third grade:</i>					
ACDC	14.5	17.0	21.4	103	
Even Start	25.0	21.2	19.4	31	
Free Lunch	20.4	22.8	21.7	1656	
<i>Fourth grade:</i>					
ACDC	11.5	13.5	12.2	90	
Even Start	13.0	13.0	13.0	23	
Free Lunch	22.5	23.7	23.8	1721	
<i>Fifth grade:</i>					
ACDC	20.8	18.9	14.3	49	
Even Start	12.0	12.0	12.5	24	
Free Lunch	26.1	25.8	25.2	1868	
<i>Sixth grade:</i>					
ACDC	18.2	19.2	17.3	52	
Free Lunch	25.1	25.1	24.2	1794	

To further confound matters, the special analysis carried out with data for December 2000 in the Phase 1 report found that by that time point (intermediate between the 2000 and 2001 figures shown in Table 1.2) special education rates had declined slightly for ACDC third graders while increasing for the matched control group. The data for Spring 2001, however, indicate that this was apparently an aberration. Between December 2000 and Spring 2001 special education placement for the ACDC grade cohort increased by three percentage points, and then continued to increase through Spring 2002 by another four percentage points. In other words, the two-year time span data for the grade 3 cohort contradicts the findings reported for Phase 1 based on an eight month time span. This finding underlines the importance of looking at longer time frames and not assigning too much significance to any one time point. It further emphasizes the importance of looking at overall patterns—in the present case, except for grade 3, all the other grade cohorts show a steady pattern of ACDC children being placed in special education less often than comparison group children, a pattern that continues into junior high school (when most of the grade 6 cohort was in eighth grade). For some reason, the grade 3 cohort was an anomaly. Statistically, the five percent confidence interval (the range which it could exceed five percent of the time) for a special education rate of 20 percent would be  $\pm 7$  percent. The differences shown Table 1.2 are usually much smaller than seven percent, so the most reasonable conclusion about the grade 3 cohort is that random variation, which according to the laws of probability is going to create unusual patterns surprisingly often, was concentrated here, producing one clear exception to an otherwise consistent pattern. The real test of whether or not random variation accounts for the unusual pattern in the third grade cohort will come when new data, for the 2002-2003 school year, become available.

### **School Success**

The Phase 1 report used special education placement as an indication that children were, for various reasons, not fitting in with the mainstream of classroom education. This has sometimes been referred to as lack of *school success*. Many studies have also used a second indicator, *grade retention*, to estimate lack of school success. In APS, grade retention occurs fairly often when kindergartners or first graders repeat for another year, and to a lesser extent after that. For our grade 1 cohort, 2.3 percent of ACDC children, and 2.2 percent of Head Start children, had been retained in grade at least once during the next two years. This compares with 4.3 percent for the Free Lunch comparison group. Lower rates of grade retention, therefore, provide another indication that children who had attended preschool are more likely to succeed in public school.

Table 1.3 looks at percentages of children in the grade 1 cohort who were *either* in special education *or* had been retained in grade two years later. The difference between these two percentages for ACDC children is 4.7, compared with 9.1 for the Free Lunch group and 9.9 percent for Head Start. Therefore, taking measures for grade 1 as the starting point, ACDC children were noticeably more likely to have succeeded in school two years later.

For both the grade 1 and 2 cohorts, therefore, rates of change between Spring 2000 and Spring 2002 were four to five percent lower for ACDC than for the Free Lunch group. This yields an annual rate of two to three percent—each year between grade 1 and grade 4, two to three percent more comparison group children than ACDC children have difficulties succeeding in mainstream classrooms. By fifth grade, as evidenced in Table 1.2, an advantage of approximately ten percentage points has opened up for ACDC students. This pattern, of course, does not fit the grade 3 cohort, and should therefore be treated as tentative. To help resolve the issue, it will be important to look at the new cohorts of children who entered APS kindergarten in 1999-2000, 2000-2001, and 2001-2002.

**Table 1.3. Lack of school success by 2002 (numbers indicate percentage of the grade 1 cohort who were either in special education or retained in grade by 2002).**

	At start of Grade 1	Two years later	Percentage difference
ACDC	9.3%	14.0%	4.7
Head Start	9.3%	19.2%	9.9
Even Start	2.3%	8.7%	6.4
All Free Lunch	10.6%	19.7%	9.1

### **English Proficiency**

APS students are given several instruments to assess their level of English proficiency, and Table 1.4 examines the percentage of children in each cohort and group classified as possessing Full English proficiency. Note that the percentages of children with Full proficiency drop steadily from grade 1 to grade 3, after which they begin to climb. Starting in 2000-2001 APS introduced a new measure, the Pre-Language Assessment Scale (Pre-LAS), which more accurately measures the English proficiency of children in the very early grades. Unfortunately, these measures were not available for the Phase 1 cohorts, so we concentrate attention here on students who had reached grade 3 or higher in Spring 2000.

ACDC and Head Start children consistently have higher rates of English proficiency when they enter kindergarten than either the comparison group or the Even Start children. The latter finding is not surprising—the Even Start program is aimed specifically at children for whom English is not the native language. The superior English proficiency of ACDC and Head Start children could be explained by two very different factors: a) The ACDC and Head Start programs do a good job of improving English proficiency while the children are in their program, or b) these programs are more likely from the very start to enroll children who speak English well, and to enroll fewer children who come from non-English-speaking backgrounds. Since the data summarized in Table 1.4 tell us only about English proficiency levels after the children are in APS, it is not possible to decide between these two explanations directly. It is possible, however, to look at changes over time in English proficiency rates. Table 1.4 shows that after they reach third grade, all groups improve at least somewhat. However, the rates of improvement do not seem to be any better for preschool children than for the comparison group.

It will be possible to look more closely at early advantages and improvements in English proficiency during the second section of this report. For now, the important consideration is that ACDC and Head Start children have and maintain a marked advantage in English proficiency relative to the comparison groups. This is important because English proficiency is not only an outcome variable, but also a good predictor of both school success and achievement test scores. Table 1.5 demonstrates this by looking at the rates of special education placement over time for children with full, somewhat limited, and seriously limited English proficiency. The percentage of children in each grade cohort and English proficiency category who were in special education in the Spring of 2000, 2001, and 2002 are shown. For Full Proficiency students there is only a slight increase in special education rates over time. But for those with some or serious limitations the increases over time are striking. By the time they enter junior high school 45 percent of students with serious English limitations are in special education. Therefore, if preschool programs make a significant contribution toward helping students improve their proficiency with English by the later elementary years, then they have also made a contribution toward improving their chances of school success.

**Table 1.4. Percent of students with Full English Proficiency, for preschool programs and students in the Free Lunch comparison group, from Spring 2000 to Spring 2002.**

	2000	2001	2002	N	
<i>First grade:</i>					
ACDC	91.9	86.1	86.7	75	
Head Start	92.6	83.5	81.6	206	
Even Start	87.0	52.3	56.8	44	
Free Lunch	88.1	75.4	73.3	1766	
<i>Second grade:</i>					
ACDC	75.2	76.0	82.3	124	
Head Start	71.2	72.8	77.9	181	
Even Start	60.4	57.4	61.7	47	
Free Lunch	57.8	57.0	64.8	997	
<i>Third grade:</i>					
ACDC	53.8	52.8	78.6	103	
Even Start	30.6	36.4	54.8	31	
Free Lunch	45.9	48.7	69.7	1656	
<i>Fourth grade:</i>					
ACDC	58.3	62.9	81.1	90	
Even Start	30.4	43.5	60.9	23	
Free Lunch	45.9	48.7	69.7	1656	
<i>Fifth grade:</i>					
ACDC	67.9	71.7	77.6	49	
Even Start	60.0	64.0	79.2	24	
Free Lunch	56.0	63.4	70.3	1869	
<i>Sixth grade:</i>					
ACDC	76.4	76.9	76.9	52	
Free Lunch	64.6	66.1	69.5	1795	

So far the analysis has been unable to dissect out any contribution made by preschool programs toward improving English proficiency, but that is clearly an area with which to be concerned in the future and in section II.

**Table 1.5. Percent of all APS students with full, limited, or no English proficiency during Spring 2000, 2001, and 2002 who were in Special Education that year, by grade in 2000.**

Grade in 2000	Full proficiency			Somewhat limited			Serious limitation		
	2000	2001	2002	2000	2001	2002	2000	2001	2002
1	8.7	11.6	13.7	n.a.	8.3	7.6	8.1	13.0	21.7
2	11.8	13.7	15.2	8.9	8.5	12.9	13.4	19.3	29.0
3	13.2	14.4	14.0	7.2	11.7	19.3	22.7	30.5	34.3
4	13.8	13.8	13.5	11.8	16.7	28.3	32.7	39.4	45.8
5	12.6	12.3	13.3	23.4	28.5	31.3	39.8	43.3	44.6
6	13.1	12.7	12.0	28.2	30.2	31.3	40.8	44.3	45.3

### Reading Achievement

The Phase 1 report found no significant or consistent pattern of differences for the grade 1-3 cohorts as of Spring 2000 between preschool programs or between the combined preschool group and the matched comparison group. Advantages were found for preschool children in the grades 4-6 cohorts, but these differences were largely accounted for by higher rates of special education placement among comparison group children. One purpose of the analysis in Table 1.6, therefore, is first of all to see if a similar pattern emerges as the grades 2 and 3 cohorts move on into grades 4 and 5. However, given that Table 1.2 has already shown that the grade 2 cohort showed only a modest preschool advantage in rate of special education placement, while for the grade 3 cohort the initial preschool advantage actually disappeared, there is no theoretical basis for expecting increased advantages in reading for either preschool cohort.

Table 1.6 presents mean Reading Assessment Scores for the grade 1 and 2 cohort, and mean Terra Nova scale scores for the grade 3-6 cohorts. The lesson of this table is that the Terra Nova reading composite scale scores of all cohort-groups in Spring 2000 improve over time, and at about the same rate. What is true for a preschool cohort in 2000 remains the same two years later. The preschool programs do not lose ground (as some earlier studies had suggested was true, but neither do they gain. This is not surprising--the literature of research on preschool programs shows rather clearly that if the program produces advantages in reading (and other achievement areas), these advantages will show up in kindergarten. While some studies have found that initial reading advantages of their preschool children "wash out" (i.e., diminish or disappear) within a few years, in many other studies the benefits of preschool continue all the way through public school. The contradiction between these findings is often attributed to the quality of the public school systems involved—if elementary schools build on the benefits poor children have acquired from their preschool experience, then the advantages in achievement scores persist. If not, then the preschool children regress toward the level of poor children who have not attended a preschool. To really know how this works in Albuquerque, however, we first need evidence that children from the preschools have higher achievement scores when they enter kindergarten. This takes us into the next section.

**Table 1.6. Mean reading achievement scores for preschool programs and students in Free Lunch program (Developmental Reading Index scores for grades one and two, Terra Nova scores from grade 3 on).**

	2000	2001	2002	N	
<i>First grade:</i>					
ACDC	2.2	2.9	605	67	
Head Start	2.2	2.9	606	170	
Even Start	2.1	2.8	606	30	
Free Lunch	2.1	2.7	610	1251	
<i>Second grade:</i>					
ACDC	2.6	612	627	108	
Head Start	2.8	613	622	166	
Even Start	2.8	611	629	41	
Free Lunch	2.5	605	621	812	
<i>Third grade:</i>					
ACDC	610	630	641	88	
Even Start	599	618	634	28	
Free Lunch	606	621	639	1441	
<i>Fourth grade:</i>					
ACDC	626	645	651	81	
Even Start	622	631	641	16	
Free Lunch	621	635	639	1472	
<i>Fifth grade:</i>					
ACDC	647	651	657	45	
Even Start	638	637	652	19	
Free Lunch	634	630	644	1613	
<i>Sixth grade:</i>					
ACDC	646	651	666	47	
Free Lunch	631	643	656	1493	

## **II. CHILDREN ENTERING APS KINDERGARTEN 1999-2000, 2000-2001, 2001-2002**

This portion of the study focuses on the cohorts of children entering APS kindergarten in 1999-2000, 2000-2001, and 2001-2002. Since most of the data examined here were collected in the Spring of each year, these groups will be referred to as Cohort 2000, Cohort 2001, and Cohort 2002. The data on Head Start children are quite complete for all three cohorts, while the data on ACDC children are incomplete for Cohort 2000, better for Cohort 2001 and complete for Cohort 2002. Data for Even Start are available only for Cohort 2001. By “complete” we mean that most children who attended the preschool were identified in such a way that it was possible to find them in the APS database and begin tracking.

The details of each cohort’s strengths and limitations are:

- *Cohort 2000.* The Phase 1 study began with children who were in first grade during 1999-2000. Some preschool children who were in Kindergarten 1999-2000 were identified at that time, but because the lists appeared to be incomplete they were not included in the analysis. In an effort to make Cohort 2000 data for the ACDC program more complete, ISR research staff went to the warehouse where old ACDC files are stored, went through the records by hand, and entered information about children who appeared to be eligible to enter kindergarten in Fall 1999. In spite of this effort, we still were only able to find 25 ACDC children in cohort 2000, which means that we have only a small sample of the actual number transitioning from ACDC into kindergarten that year. Furthermore, we have no information on how representative this group is of the whole ACDC population during that year. Head Start began maintaining a computerized database for the 1999-2000 year, so identifying and tracking the Head Start children was straightforward. Even Start records, on the other hand, had been disrupted by organizational changes at APS to the extent that the Even Start classrooms could not be distinguished from the large number of other preschool programs APS offers, mostly for children with special needs.
- *Cohort 2001.* ACDC implemented a computer database during the 2000-2001 year, so relatively complete lists were available for ACDC. For Cohort 2001 Head Start provided not only complete lists of who had applied to or enrolled in the program, but additional information on children’s demographics and experience in Head Start. These data made possible useful analyses that help refine and extend the core analysis. Thirty-six Even Start children were identified for Cohort 2001, enough to analyze but certainly not a full representation of all Even Start children.
- *Cohort 2002.* For the cohort entering kindergarten 2001-2002 the ACDC and Head Start databases were in full operation. Even Start records, however, could be located in the APS database only for a few Even Start classrooms. For this reason, the analysis of Even Start children reported here is restricted to the 2001 cohort.

### **Comparison Groups**

The importance of, and problems involved with, comparison groups were discussed at some length in the introduction. For the three kindergarten cohorts under analysis here, we begin by identifying comparison groups as in section I (children on the Free Lunch program who also attended a public preschool, and all other children on the Free Lunch program). No matched comparison group analogous to the one in Phase 1 was selected, because the procedure proved to be unreliable. For a

more comprehensive comparison two more groups are added: a) children on the Reduced Price Lunch program (and not in one of the three preschool groups), and b) those not in any lunch support program and also not in a preschool group. After carrying out analysis using these comparison groups we will try an even more fine-grained approach, using seven different kinds of pre-kindergarten experience and all three categories of lunch support (Free, Reduced Price, and None).

### Demographics

Table 2.1 and 2.2 show background information (sex and ethnicity) on the three cohorts from APS records. Table 2.1 does not indicate any consistent differences between the preschool groups and the comparison groups on sex distribution.

**Table 2.1. Sex distribution of preschool and comparison groups in Cohort 2000 (1999-2000), Cohort 2001 (2000-2001), and Cohort 2002 (2001-2002).**

Sex:	Cohort 2000			Cohort 2001			Cohort 2002		
	Girls	Boys	N	Girls	Boys	N	Girls	Boys	N
ACDC	48.0	52.0	25	52.5	47.5	80	52.7	47.3	169
Head Start	47.9	52.1	424	51.1	48.9	599	48.4	51.6	665
Even Start				44.4	55.6	36			
Free Lunch+Preschool	46.2	53.8	132	43.9	56.1	214	51.1	48.9	223
Free Lunch only	51.3	48.7	918	47.5	52.5	1401	47.0	53.0	1355
Reduced Price only	46.2	53.8	221	48.8	51.2	291	49.8	50.2	253
No Lunch Aid only	49.3	50.7	2223	48.3	51.7	2262	50.3	49.7	2233

Table 2.2 shows that concentrations of Hispanics in the five lowest-income groups are usually above 70 percent. ACDC, Head Start, and both groups of children on Free Lunch are closely similar, but

**Table 2.2. Ethnicity of preschool and comparison group children in each cohort.**

	African		Hispanic	Native		Other or mixed	N
	Anglo	American		American	Asian		
<i>Cohort 2000</i>							
ACDC	8.0	4.0	76.0	12.0			25
Head Start	16.7	5.2	71.9	5.0	0.5	0.7	424
Free Lunch+Preschool	12.1	3.8	75.8	6.8		1.5	132
Free Lunch only	12.9	3.7	77.0	4.6	1.0	0.9	918
Reduced Price only	24.0	2.3	64.3	5.9	1.8	1.8	221
No Lunch Aid only	51.6	3.4	38.9	3.5	1.5	1.2	2223
<i>Cohort 2001</i>							
ACDC	13.8	7.5	65.0	8.8	3.8	1.3	80
Head Start	16.0	5.2	71.0	6.3	1.0	0.5	599
Even Start		2.8	97.2				36
Free Lunch+Preschool	9.3	4.7	79.4	5.6	0.5	0.5	214
Free Lunch only	10.8	3.9	79.3	4.4	1.0	0.6	1401
Reduced Price only	21.0	2.4	67.7	5.2	2.1	1.7	291
No Lunch Aid only	51.3	3.7	37.1	4.3	2.3	1.3	2262
<i>Cohort 2002</i>							
ACDC	14.8	1.2	72.2	7.1	3.0	1.8	169
Head Start	14.1	4.4	73.8	5.1	1.2	1.4	665
Free Lunch+Preschool	13.9	1.3	75.8	7.6	0.4	0.9	223
Free Lunch only	12.0	4.1	77.7	3.5	1.4	1.3	1355
Reduced Price only	29.6	3.2	59.7	4.0	1.6	2.0	253
No Lunch Aid only	51.0	3.8	36.3	4.6	2.3	2.0	2233

Even Start (which due to data problems appears only in cohort 2001) is 97 percent Hispanic, a much higher percentage than any other group in any cohort. This, however, is consistent with the intention of Even Start (noted in the previous section) to concentrate on children for whom English is a second language.

### Achievement test scores

The three cohorts of children entering kindergarten were assessed by APS teachers using the Kindergarten Developmental Progress Report (KDPR) but somewhat different versions were administered each year. In Spring 2001 the cohort 2000 children took the first grade reading assessment, and in Spring 2002 the second grade reading assessment, so we have longitudinal data over three time points for this cohort. APS ceased administering the first grade reading assessment in 2002, so no first grade data are available for Cohort 2001. Cohort 2002 children were still in kindergarten during Spring 2002, so only KDPR language and math scores are available for them.

**Table 2.3. Percentages of children entering APS kindergarten in Cohorts 2000, 2001, and 2002 who scored “Proficient” on the KDPR and Grade 1 Reading Assessments, and Grade 2 Reading Assessments for Cohort 2002. Different versions of the KDPR were used during different years. No grade 1 reading assessment was given in school year 2001-2002.**

Children entering kindergarten in:	Kindergarten:		Grade 1	Grade 2 Reading:		N
	KDPR scores for:		Reading Total	% Below grade level	Grade level of reading:	
<i>Cohort 2000</i>	Language	Math				
ACDC	48.0%	37.5%	45.0%	25.0%	2.58	24
Head Start	42.2%	39.0%	36.3%	33.4%	2.22	361
Free Lunch+Preschool	34.1%	33.9%	31.9%	42.4%	1.93	117
Free Lunch only	36.3%	36.1%	37.3%	35.6%	2.13	769
Reduced Price only	59.7%	56.3%	51.5%	24.2%	2.48	185
No Lunch Aid only	63.7%	59.7%	58.1%	15.4%	2.66	1909
Confidence interval for ACDC (1-tailed, 5%)	16.8 %	16.3%	16.8%	14.5%	.45	
<i>Cohort 2001</i>	Total					N
ACDC	56.3%					80
Head Start	45.1%					599
Even Start	75.0%					36
Free Lunch+Preschool	48.1%					214
Free Lunch only	41.0%					1401
Reduced Price only	54.6%					291
No Lunch Aid only	63.1%					2262
Confidence interval for ACDC (1-tailed, 5%)	9.2%					
<i>Cohort 2002</i>	Language	Math				N
ACDC	54.4%	74.0%				125
Head Start	43.5%	63.0%				419
Free Lunch+Preschool	47.1%	62.3%				139
Free Lunch only	41.0%	58.8%				797
Reduced Price only	54.9%	70.0%				177
No Lunch Aid only	60.2%	69.8%				1559
Confidence interval for ACDC (1-tailed, 5%)	7.4%	6.5%				

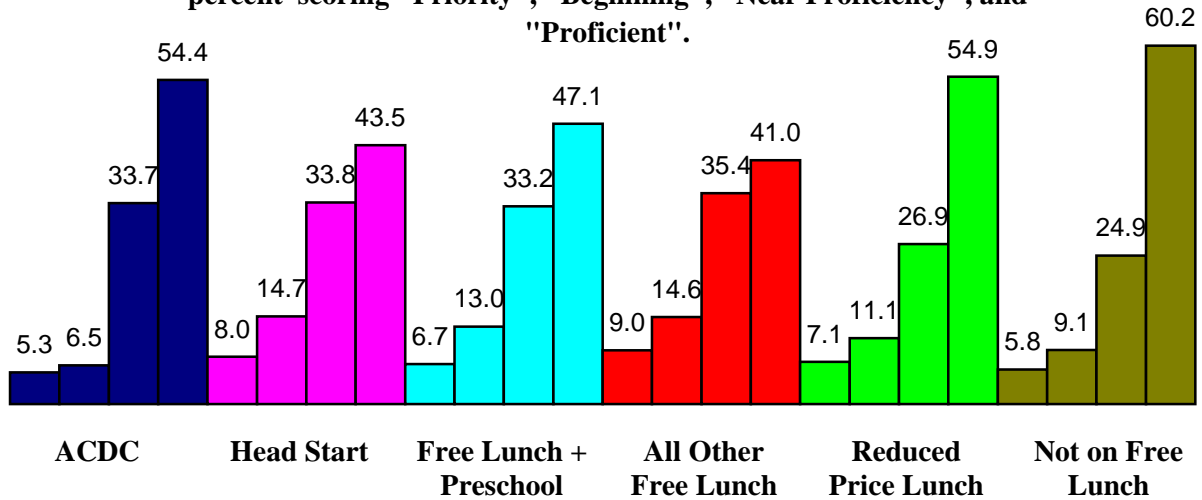
Children are scored on the KDPR and Grade 1 Reading Assessment items as “Proficient”, “Nearly Proficient”, “Beginning” and “Priority”, with most children demonstrating “proficiency”. For the 2000 and 2002 KDPR, summary classifications were available that scored separately on the language and math subscales, but in 2001 only scores on individual items were available. To facilitate comparisons, we took the total number of items on which a child scored “Proficient”, and then assigned this total to the categories “Proficient”, “Nearly Proficient”, “Beginning” and “Priority” in such a way as to approximate the distribution of cases in the 2002 KDPR. We used the same method for the first grade Reading Assessment scores of Cohort 2000 children. No grade 1 reading assessment was given 2001-2002, so there are no results for Cohort 2001 children who were in first grade in 2002. For grade 2, Table 2.3 shows the percent of children in each Cohort 2000 group who were below grade level in reading according to the Grade 2 Reading Assessment, and the mean grade level of their reading achievement.

Table 2.3 shows the percent of children in each cohort and group achieving “Proficient” status on the versions of the KDPR given each year and on the first grade Reading Assessment, the percent whose reading was below grade 2 level in 2002, and the mean reading level (in terms of expected grade level) in 2002. To highlight the important findings in Table 2.3 more graphically, Figures 2.1-2.4 present the same information as bar charts. The most up-to-date version of KDPR, taken by the most complete cohort of ACDC children, was given in Spring 2002. Figures 2.1 and 2.2 show the percentages of Cohort 2002 children in each achievement category on the KDPR Language and Math sections. The findings here are strong. Fifty-four percent of kindergartners who had attended ACDC were proficient in language, compared with percentages in the 41-47 range for Head Start and the two Free Lunch groups. In fact, the ACDC children performed at essentially the same level as the Reduced Price children, who come from somewhat more middle-income families.

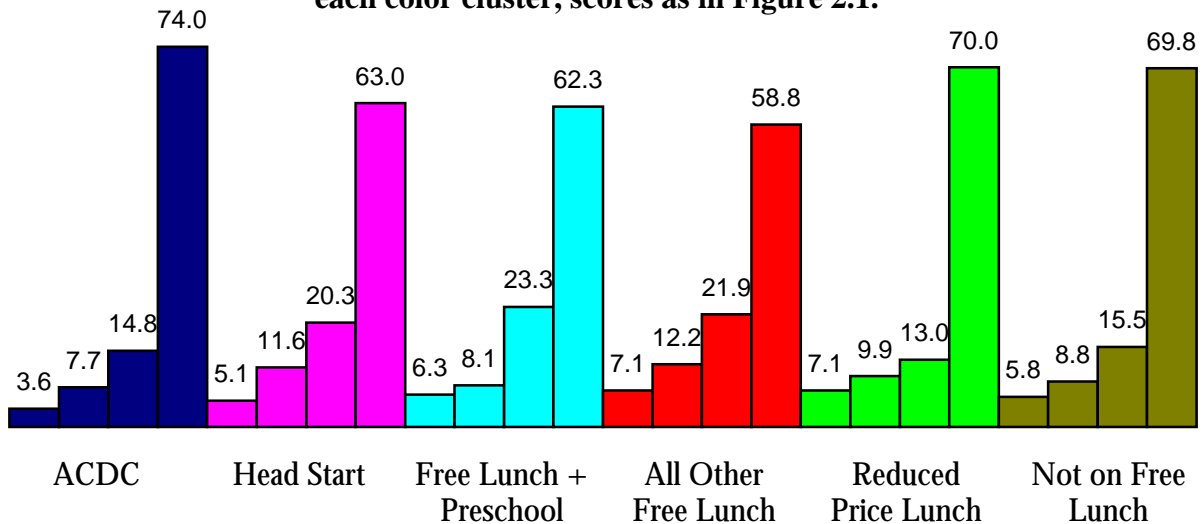
Table 2.3 also shows five percent confidence intervals for each ACDC statistic. Confidence intervals are more appropriate here than tests of statistical significance because they allow ACDC to be compared with any of the range of comparison groups, rather committing to one specific group to serve as the “gold standard”. None of these groups comes close to being perfect for purposes of comparison, but their range provides a context within which ACDC results can be situated. The figures given as confidence intervals can be read like this: In Cohort 2002, 54.4 percent of ACDC children scored “proficient” on the KDPR language scale. A one-tailed confidence interval means that we expect ACDC to perform better than the other groups, so we concentrate on the probability that the 54.4 percent figure happened purely by chance and that the true figure was somewhat lower. The five percent confidence interval (7.4 percent) then tells us that 95 percent of the time the true figure would be no less than  $54.4 - 7.4 = 47.0$  percent. Forty-seven percent is higher than the percentages for Head Start and the Free Lunch Only group, so we can conclude that the chances that the true performance of ACDC children, relative to either of these groups, must be a real difference, not random chance, with 95 percent probability. However, the figure for the Free Lunch+Preschool group (48.1) percent, is slightly above the confidence interval, and does not meet the .05 probability criterion. The same interpretation applies to the other confidence intervals.

For the KDPR math scales, the results are even more impressive. As Figure 2.2 shows, 74 percent of ACDC children were proficient in math, compared with percentages below 63 for the three low-income groups and only 70 percent for the children receiving reduced-price lunches or no lunch support at all. Furthermore, fewer ACDC children were in the Priority and Beginning categories in math than any other group. This is a noteworthy performance. On the KDPR math subscale the ACDC children scored above the confidence interval relative to Head Start and both Free Lunch

**Figure 2.1. Cohort 2002: Mean KDPR Language Scores for Preschool and Comparison group children. From left to right, for each color cluster, percent scoring "Priority", "Beginning", "Near Proficiency", and "Proficient".**



**Figure 2.2. Cohort 2002 KDPR Math scores. From left to right, for each color cluster, scores as in Figure 2.1.**



groups, but although they also scored higher than the two higher income groups, they not did not exceed the confidence interval relative to these two groups.

The same pattern is evident in Cohort 2001 (see Figure 2.3). The percentage of ACDC students proficient on the 2001 is higher than for the three other low-income groups, and slightly higher than the Reduced Price group. ACDC children scored above the confidence interval separating them from Head Start and the Other Free Lunch group.

Finally, for Cohort 2000 the small number (N=24) of ACDC children is responsible for the much larger confidence intervals shown in Table 2.3, which means that when ACDC has an advantage over other groups it rarely exceeds the confidence interval. In the absence of a statistical basis for confidence, we can look just at the cases where ACDC scores are better than those of other groups (see Figure 2.4). The ACDC children identified for Cohort 2000 performed better than the other low-income groups on the KDPR Language component and the first and second grade reading assessments—but not on the KDPR Math component, where Head Start children did slightly better. Moreover, the ACDC children were below the Reduced-Price children on all scores except Grade 2 reading level. Overall, then, the twenty-four ACDC children in Cohort 2000 did not perform as well as the ACDC children in Cohorts 2001 and 2002.

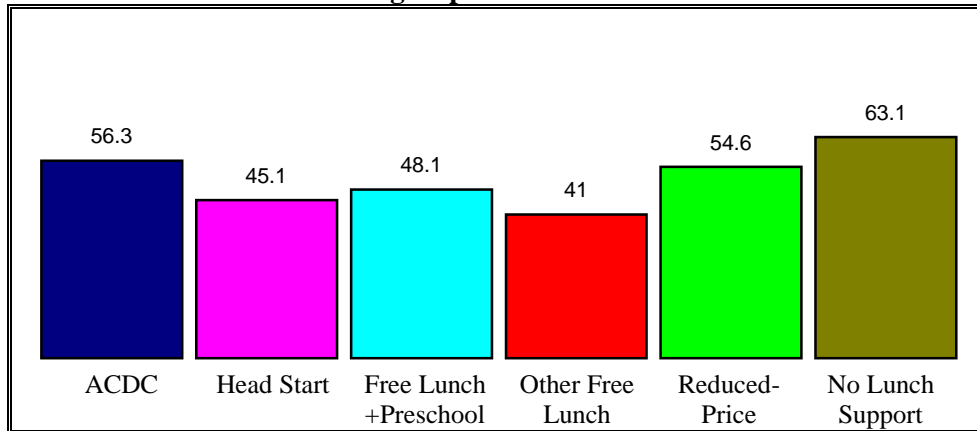
Given that the Phase 1 report found no differences between ACDC, Head Start, and the comparison group on first and second grade reading assessments, these Phase 2 findings suggest that ACDC children began improving in 2000, and accelerated their progress through 2001 and 2002. A more conclusive test of that suggestion, however, will require waiting for new data for 2003, 2004, etc.

### **Extending the Range of Comparison Groups to All Combinations of Pre-Kindergarten Experience and Free Lunch Status**

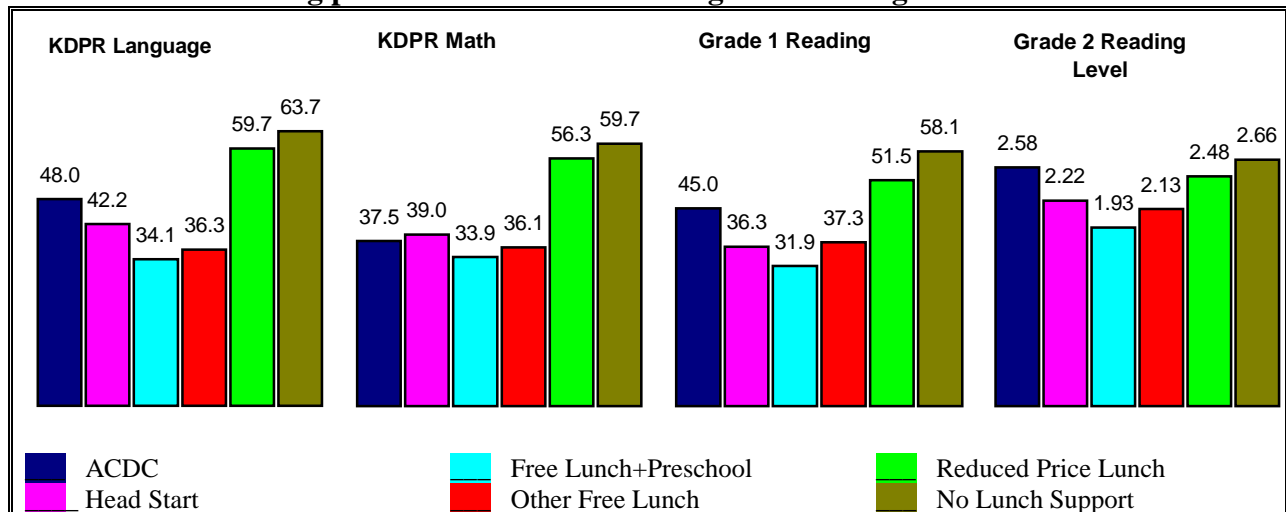
Because using a range of possible comparison groups worked well in the preceding analysis, the present section extends the range even further. The two measures used in selecting comparison children who are similar to the preschool children have been a) lunch support status in kindergarten, and b) parents' reports about their child's pre-kindergarten experience. There are actually seven categories of pre-kindergarten experience available for analysis: ACDC, Head Start, Even Start (Cohort 2001 only), children whose parents told APS that they had attended a public preschool, a private preschool, or no preschool, and a final category composed of parents who did not respond to that APS enrollment form question at all. Because there are also three categories of free lunch status, a finer-grained analysis can be carried out for Cohort 2002 by looking at all eighteen permutations obtained by cross-classifying pre-kindergarten experience and free lunch status. For each pre-kindergarten group, the percentages of children in each lunch support category are shown in Table 2.4.

Far more Head Start children (74 percent) are in the Free Lunch program than children from any other pre-kindergarten category, which is consistent with the fact that family income must be at or below the poverty line for children without disabilities to attend Head Start. While the ten percent of children with disabilities can have higher incomes, the family incomes of the non-disabled 90 percent of Head Start children at time of enrollment were therefore well below the Free Lunch standard (130 percent of the poverty index). Only 52 percent of ACDC children receive free lunches, while 18 percent are in the Reduced-Price program, and there are two possible reasons for this. First, because ACDC families can have incomes up to 175 percent of the poverty line at time

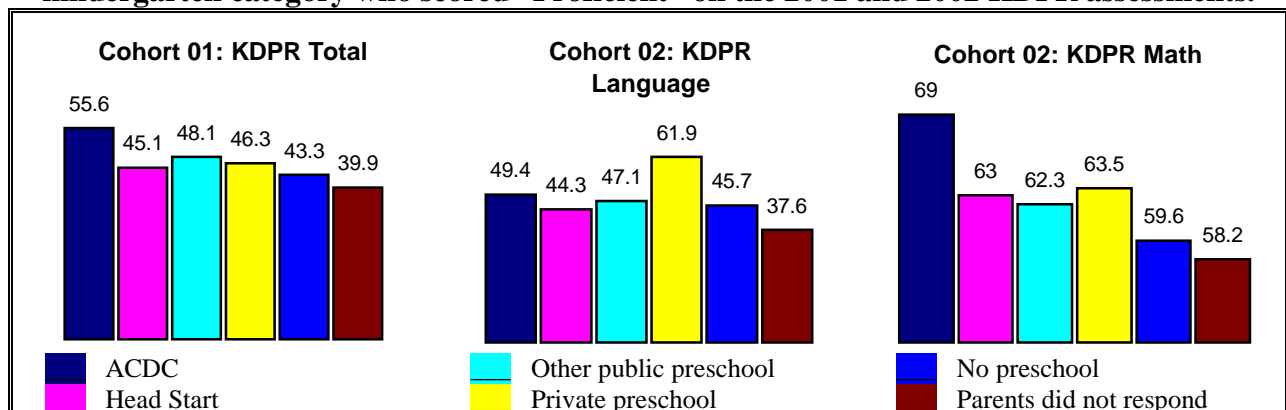
**Figure 2.3. Percent of each Cohort 2001 group rated Proficient overall on the 2001 KDPR.**



**Figure 2.4. Percentages of each Cohort 2000 group rated Proficient on the 2001 KDPR language and math scales and the first grade Reading Assessment, and mean grade level of reading performance on the second grade Reading Assessment.**



**Figure 2.5. For children on the Free Lunch program only, percent of those in each pre-kindergarten category who scored "Proficient" on the 2001 and 2002 KDPR assessments.**



**Table 2.4. Percent of Cohort 2002 children with each type of pre-kindergarten experience who were in the Free Lunch, Reduced Price, or no lunch support program.**

Pre-Kindergarten Experience:	No lunch support	Reduced price program	Free Lunch program	N
ACDC	30.2	18.3	51.5	169
Head Start	19.7	6.0	74.3	665
Other public preschool	58.5	5.6	35.9	622
Private preschool	89.4	2.2	8.5	744
No preschool	51.5	9.2	39.4	950
Parents did not respond	40.9	6.6	52.5	1748

of enrollment, it follows that many ACDC children would only be eligible for Reduced-Price lunch support, because their families' incomes were more than 130 percent of poverty. But second, ACDC tries especially hard to work with the parents and help them to improve their economic position. Some of the ACDC families who were eligible only for Reduced Price lunch support when their children were in kindergarten might have accomplished an improvement in income due to the help of ACDC. We cannot currently distinguish between these two possibilities, but as better data on the incomes of ACDC families at the time their children were enrolled become available, we will at least be able to determine how many families improved their incomes sufficiently to cross the line between Free Lunch and Reduced Price Lunch requirements.

Another feature of Table 2.4 deserves comment. It is reasonable that 89 percent of children reported to have attended a private preschool receive no lunch support (the 8.5 percent who are on the Free Lunch program would presumably be children on special scholarships). But it is not clear why 59 percent of the children reported to have attended some other public preschool program would receive no lunch support while only 36 percent receive free lunches. It appears that while most children do not receive lunch support because their family incomes are too high, a second (and smaller group) are eligible in terms of family income but for one reason or another their parents do not take the necessary steps to enroll their children in the lunch support program. This would explain why some categories of Table 2.4 have fairly high percentages both of children receiving free lunches and children not receiving any support. If this conjecture is true, it suggests that one reason so few ACDC and Head Start children receive no lunch support is that their parents are more informed about the Free/Reduced Price Lunch program, and more diligent about taking steps to benefit from it.

With these complexities in hand, Table 2.5 breaks down lunch support status by pre-kindergarten experience for Cohorts 2001 and 2002 (there are not enough ACDC children in Cohort 2000 to allow analysis), and gives the percentage of children in each group rated as "proficient" on the KDPR assessments. The most important portion of this table is the bottom section, for children with Free Lunch support. Because all children in this section come from families with incomes below 130 percent of poverty, income differences between ACDC and Head Start families are to a considerable extent statistically controlled (the remaining inequality occurs because ACDC families with incomes between 100 and 130 percent of poverty at the time the child enrolls in kindergarten would be included; in contrast, because all non-disabled Head Start children had to come from families with incomes no more than 100 percent of poverty at the time of enrollment in Head Start, only those whose families *improved* their incomes by the time they enrolled in kindergarten would be in the 100-130 percent range). So the ACDC group receiving Free Lunch support in Table 2.5 probably still has some overall income advantage relative to the Head Start group.

**Table 2.5. Percent of Cohort 2001 and 2002 children who are proficient on the KDPR, by lunch support status and type of pre-kindergarten experience. Confidence intervals at the .05 level for ACDC percentages shown in parentheses.**

Free Lunch Status and Pre-Kindergarten Experience:	Cohort 2001		Cohort 2002		
	KDPR Total % Proficient	N	Language % Proficient	Math % Proficient	N
<i>No Lunch Support Program</i>					
ACDC	68.0	25	52.9	74.5	51
Head Start	45.1	133	38.2	61.1	131
Other public preschool	61.8	398	55.2	65.1	364
Private preschool	70.8	637	70.8	80.0	665
No preschool	57.7	562	57.7	63.0	489
Parents did not respond	61.2	665	54.5	67.4	715
<i>Reduced-Price Program</i>					
ACDC	30.0	10	71.0	87.1	31
Head Start	45.2	31	50.0	70.0	40
Other public preschool	60.4	48	71.4	77.1	35
Private preschool	47.6	21	81.3	87.5	16
No preschool	47.4	78	56.3	71.3	87
Parents did not respond	57.6	144	45.2	64.3	115
<i>Free Lunch Program</i>					
ACDC	<b>55.6</b>	45	<b>49.4</b>	<b>69.0</b>	87
Head Start	45.1	435	44.3	63.0	494
Other public preschool	48.1	214	47.1	62.3	223
Private preschool	46.3	54	61.9	63.5	63
No preschool	43.3	337	45.7	59.6	374
Parents did not respond	39.9	1010	37.6	58.2	918
Confidence interval for ACDC (1-tailed, 5%)	12.2		8.8	8.2	

In the bottom, “Free Lunch Program”, section of Table 2.5 the percentages for ACDC are in bold so they can easily be compared with the other groups (for a graphic presentation see Figure 2.5). With one exception, more ACDC children receiving free lunches are proficient on the KDPR scales than any other pre-kindergarten group. That exception is the Private Preschool group on the 2002 KDPR language subscale. This is a small group (N=63), but the confidence interval for it (sticking with the one-tailed version) is 10.2. This sets the .05 lower bound at 51.7, which is higher than any of the other pre-kindergarten, Free Lunch, groups, including ACDC. Because the 2002 language subscale is the only one of the three KDPR measures shown in Table 2.5 in which the Private Preschool group is highest, the degree of confidence one attaches to this result should be muted. Nevertheless, the language measure is particularly important, and attention should be given to private preschool children in the future—what are their characteristics, and what mechanisms made it possible for them to enroll in private programs?

On the 2001 KDPR total and the 2002 KDPR math subscale, for children receiving Free Lunch support, higher percentages of ACDC children were proficient than for any other group. However, restricting the analysis to children receiving free lunches means that the numbers of cases are smaller, and the confidence intervals larger, than in Table 2.3. Overall, the fact that more ACDC children are Proficient on all but one of the fifteen Free Lunch comparisons establishes a consistent pattern that adds more weight to the findings. However, the fact that ACDC children on the Free Lunch program did substantially better on the math portion than on the language portion of the

2002 KDPR is interesting. ACDC will be testing new methods for encouraging the development of early reading skills next year (2003-2004), and the research team will monitor these innovative efforts closely as the children progress in APS in the future.

Another feature of Figure 2.5 deserves comment. While children reported by their parents to have not attended any preschool tend to rank low in the three charts, the children who *consistently* score the lowest are those whose parents left the response form blank. This is the largest single group, 43 percent of all Free Lunch students, so it will be important to find out more about who these families are and why their children are not included in preschool programs.

We can get some idea of how much difference family income makes by comparing the ACDC advantages over Head Start in Table 2.3 (in which Free Lunch status was not controlled) and in Table 2.5. For Cohort 2002 in Table 2.3 the difference in percent proficient on the KDPR language scale between ACDC and Head Start was 10.9 percent, and on the math scale 11.0 percent. The corresponding percentage differences in Table 2.5, for Free Lunch children only, were 5.1 and 6.0 percent. Therefore, when some of the variation in income eligibility between ACDC and Head Start is controlled by restricting the analysis to children receiving Free Lunch support, the advantage of ACDC children remains but is reduced to about half what it was without the control.

There are so few children in the Reduced Price section of Table 2.5 that little can be made of the variations. The remaining category, children receiving no lunch support, is difficult to interpret because it contains two kinds of families, those with incomes above 185 percent of poverty and those below 185 percent who did not take the necessary steps to enroll their children in the program. It makes sense that large numbers of children in the “no lunch support” section of Table 2.5 would have attended private preschools, and that they would perform well on the KDPR scales. These should primarily be children from higher income families. But it seems likely that the children from ACDC, Head Start, and other public preschools who receive no lunch support, but whose families had low incomes at the time of enrollment in preschool, probably include a disproportionate number from families who were eligible for lunch support but simply did not register. Because the families of children who attended a public preschool (ACDC included) must have low incomes when the children enroll, failures to register will be concentrated in this group. This creates muddiness in the dataset; to clean things up we will simply exclude the No Lunch Support category from further analysis.

### **Multivariate Analysis of KDPR Proficiency**

The direction of the analysis so far has been to create larger and larger numbers of comparison groups so that subgroups within ACDC cohorts can be compared with a range of other groups each with different, but specific, characteristics. This is useful for achieving more control over what is compared, but as we break the total population down into smaller and smaller pieces, the confidence intervals increase and the figures become more difficult to interpret. To put the pieces back together in a way that allows fine-grained analysis while retaining statistical power, this section constructs mathematical models that represent a number of variables simultaneously.

The purpose of the model is to understand the factors that determine whether a child will score proficient or less than proficient on a KDPR scale or subscale. We are most interested in understanding the extent to which participation in the ACDC program serves to increase the chances that the child will score “proficient”. We will compare the scores of ACDC children with the scores of all other children who attended a preschool program (Head Start, private, and other

public preschools combined), and then compare the scores of this Preschool group with the scores of children who did not attend a preschool (the “No preschool” and “Parents did not respond” groups combined). At the same time, we will compare scores for children on the Free Lunch and the Reduced Price Lunch programs, leaving out the “No Lunch Support Program” group because of the muddiness referred to above.

Because the dependent variable (KDPR score) is dichotomous (proficient or less than proficient), the appropriate statistical model is logistic regression. When we ask this model to estimate the effects of ACDC, other Preschools, and Lunch Support Status on the 2001 KDPR total score and the 2002 KDPR language and math subscales, we get the results shown in Table 2.6.

**Table 2.6. Logistic regression analysis estimating the effects of ACDC, Preschool, and Lunch Support status on proficiency (vs. non-proficiency) on the 2001 and 2002 KDPR.**

Dependent variables:	2001 KDPR Total		2002 KDPR Language		2002 KDPR Math	
Independent variables:	B	Significance	B	Significance	B	Significance
ACDC vs. Preschool	.089	.750	.200	.316	.377	.090
Preschool vs. No Preschool	.229	.008	.295	.001	.206	.020
Reduced Price vs. Free Lunch	.414	.000	.525	.000	.472	.000

The B’s in Table 2.6 are regression estimates of the amount of effect each independent variable has on the dependent variables. For all three dependent variables, family income (Reduced Price vs. Free Lunch support) has the strongest effect, with B’s ranging from .41 to .53, and these estimates are highly significant. This is not surprising—children from somewhat higher income families (Reduced Price) typically perform better in school than children from low-income families, and the purpose of public preschool programs is to make up for as much of the disadvantage of being from a low-income home as possible. In Table 2.6 the public preschools other than ACDC show a positive effect, relative to children with no preschool experience, of between .21 and .30, and these effects are significant at from the .001 to the .02 level. Therefore, although we cannot say that preschool experience is the only difference between the Preschool and the No Preschool children (there almost certainly are some differences in their families and in their parents’ motivations), the advantage in KDPR scores for Preschool children is roughly half the advantage of Reduced Price children relative to Free Lunch children—an important contribution.

The B’s estimating the effect of attending ACDC relative to the other preschool programs range from .09 to .38—a wide range of variation, reflecting the much smaller numbers of ACDC children compared with the Preschool and Non Preschool categories. These numbers estimate the effect of ACDC compared with the Preschool group, over and above the effect of Preschool relative to No Preschool, so in this sense the numbers are additive, and the total effects of ACDC relative to the No Preschool group are .32, .50, and .59, respectively—close to or greater than the effects of being in the Reduced Price group.

Therefore, when the statistical analysis takes account of both Free and Reduced Price children, the ACDC children are consistently more proficient on the 2001 and 2002 KDPR tests than children attending other preschool programs, and both groups are substantially and significantly more likely to score “proficient” than children in the same income categories who did not attend preschool.

### Special Education, Grade Retention and School Success

The components of *school success* (avoiding placement in special education and retention in grade) are shown in Table 2.7. Cohort 2000 ACDC children, and Cohort 2001 ACDC and Even Start children, are less likely than other low-income groups (including children receiving Reduced Price lunches) to have had problems with school success. The reason the rates for ACDC are low is that their grade retention rates are zero—no ACDC children in cohorts 2000 or 2001 were held back (we will not know how many children in cohort 2002 fail to reach first grade until 2003). Since most children placed in special education during the early grades have physical or cognitive deficits, grade retention is probably a better indicator of lack of success in school than special education placement. The disadvantages of using special education as an indicator of lack of school success apply particularly to Head Start children, ten percent of whom were admitted to Head Start *because of* disabilities.

**Table 2.7. Lack of School Success: Percent of children entering APS kindergarten in Cohorts 2000, 2001, and 2002 who were in Special Education during Spring 2000, 2001, and 2002, had been retained in grade at some time, and were either in special education or retained in grade by Spring 2002.**

Children entering kindergarten in:	In Special Education during:			Retained in grade by 2002	Problems with school success	N 2002
	2000	2001	2002			
<i>Cohort 2000</i>						
ACDC	0.0	16.0	16.0	0.0	16.0	25
Head Start	6.4	11.6	15.8	6.8	21.5	424
Free Lunch+Preschool	6.1	12.1	18.9	3.0	21.2	132
Free Lunch only	4.4	8.6	12.9	5.3	17.9	918
Reduced Price only	5.4	9.5	11.8	4.1	16.3	221
No lunch support only	5.3	8.9	10.3	2.1	13.7	2223
<i>Cohort 2001</i>						
ACDC		6.3	5.0	0.0	5.0	80
Head Start		6.5	10.7	2.3	12.4	599
Even Start		0.0	0.0	2.8	2.8	36
Free Lunch+Preschool		4.7	9.8	2.3	12.1	214
Free Lunch only		4.7	8.3	4.1	11.9	1401
Reduced Price only		4.5	8.6	3.1	11.3	291
No lunch support only		5.7	8.9	1.7	10.3	2262
<i>Cohort 2002</i>						
ACDC			6.5			169
Head Start			5.6			665
Free Lunch+Preschool			3.1			223
Free Lunch only			6.3			1355
Reduced Price only			8.3			253
No lunch support only			6.3			2233

For these reasons, the focus will now be on grade retention. Aside from ACDC, the children with the lowest rates of grade retention are those who receive no lunch support at all. This would be expected of children from middle- or upper-income families, but it reinforces the importance of controlling for the effects of income. To accomplish this control, Table 2.8 is restricted to Cohort 2001 children receiving Free Lunch support. The numbers are small, and aside from ACDC the grade retention rates are fairly close together, so the figures in Table 2.8 should be treated as tentative. However, the suggestion is that ACDC children may be more successful than other low-income children in staying with the mainstream of their classroom through the early years of

elementary education. The word “suggestion” is key here, because with only 45 ACDC students to track, if only one of them had been held back the “percent retained in grade” would have been 2.2, barely lower than the other groups. As additional tracking data are accumulated in the future, it will be important to monitor these trends.

**Table 2.8. For children receiving Free Lunch support only, percentage of Cohort 2001 pre-kindergarten groups retained in grade by 2002.**

Pre-Kindergarten experience:	% Retained in grade	N
ACDC	0.0	45
Head Start	2.5	435
Even Start	3.1	32
Other public preschool	2.5	214
Private preschool	4.7	54
No preschool	3.1	337
Parents did not respond	4.0	1010

### English Proficiency

English proficiency categories for children in all three cohorts are shown in Table 2.9. Overall, by 2002 ACDC and Head Start children were more likely to be fully proficient in English, and Even Start children (because the program concentrates on those for whom English is not the primary language) to have more limited proficiency, than children in the two Free Lunch comparison groups. However, the figures in Table 2.9 need some explaining. For school year 1999-2000 the measure of English proficiency was the same as that reported in section I. One characteristic of this measure was to leave in the full proficiency category kindergarten and first grade students who would later be reclassified as somewhat or severely limited in English--hence the very high percentages of “full English proficiency” for Cohort 2000 during Spring 2000.

Starting in 2000-2001 English proficiency measures based on the Preliminary version of the Language Assessment Scale, or “Pre-LAS”, became available. With the Pre-LAS used for kindergarten and first grade classification in 2001 and 2002, fewer children are in the full proficiency category, and ACDC and Head Start students usually have higher proficiency rates than the comparison groups. One interesting feature of Table 2.9 is the modest but consistent tendency for the Free Lunch children who have not attended a preschool to be less proficient in English. Expressing this in a different way, the suggestion is that children whose parents do not speak English are less likely to attend a public preschool of any kind. If so, this deserves attention because these are precisely the children who could especially benefit from an appropriate program.

Table 2.10 provides a slightly different perspective on the English proficiency of children in the comparison groups by restricting the analysis to children on the Free Lunch program and showing “percent English proficient” for all pre-kindergarten groups. Two features are worth noting. First, the low-income children who attend a private preschool have the highest rates of English proficiency during kindergarten. Whatever the income-support mechanisms that make it possible for low-income children to attend private preschools, it appears that non-English speaking children do not benefit from them. Second, except for Even Start, which intentionally recruits children for whom Spanish is the primary language, by far the lowest rates of English proficiency are for children

**Table 2.9. Percent of children entering APS kindergarten in Cohorts 2000, 2001, and 2002 with full English proficiency during Spring of 2000, 2001, 2002.**

Children entering kindergarten in:	Full English proficiency in:			N
	2000	2001	2002	
1999-2000				
ACDC	100.0	76.0	80.0	25
Head Start	99.8	76.2	78.8	424
Free Lunch+Preschool	100.0	69.7	68.9	132
All Other Free Lunch	99.5	62.6	63.7	918
Other Reduced Price	99.5	81.9	84.2	221
Other No lunch support	100.0	91.0	92.0	2223
2000-2001				
ACDC		78.8	87.5	80
Head Start		69.4	77.6	599
Even Start		25.0	44.4	36
Free Lunch+Preschool		61.7	73.8	214
All Other Free Lunch		52.6	60.7	1401
Other Reduced Price		74.6	80.8	291
Other No lunch support		90.8	93.0	2262
2001-2002				
ACDC			75.7	169
Head Start			70.1	665
Free Lunch+Preschool			22.2	223
All Other Free Lunch			61.0	1355
Other Reduced Price			53.2	253
Other No lunch support			77.5	2233

whose parents simply left blank the question on the APS enrollment form that asks about pre-kindergarten experience. The registration form is available in both English and Spanish (and Vietnamese), so non-English-speaking parents should not have avoided the question for that reason. Nevertheless, it appears that children from non-English-speaking families either did not attend a preschool or had parents who did not answer the question about pre-kindergarten experience.

**Table 2.10. For children on Free Lunch only, percent of each pre-kindergarten group proficient in English during 2001 and 2002.**

Pre-Kindergarten experience	Cohort 2001			Cohort 2002	
	2001	2002	N	2002	N
ACDC	80.0	88.9	45	67.8	87
Head Start	65.7	74.0	435	64.8	494
Even Start	25.0	43.8	32		
Other public preschool	61.7	73.8	214	61.0	223
Private preschool	83.3	87.0	54	87.3	63
No preschool	66.5	72.4	337	61.5	374
Parents did not respond	46.3	55.4	1010	47.5	918

While it appears from this evidence that children who attended ACDC or Head Start are more likely to be English proficient by grades 1 or 2, we do not know if this occurred because of something positive the preschools did or simply because the preschools were admitting higher proportions of students who already speak English well. Table 2.11 allows us to look at this more closely. Head Start data for Cohorts 2001 and 2002, and ACDC data for Cohort 2002, include the child's "primary language", as reported by the parent at the time the child first enrolled in the preschool. According to these data, between one quarter and one third of the children for whom Spanish was the primary

language at the time of enrollment were classified two or three years later in APS (Spring 2002) as fully proficient in English. This could suggest improvement in English proficiency based on preschool experience. Or it could mean that many of the preschool children with Spanish as their primary language were already more-or-less bilingual when they enrolled in preschool. One hint that preschool experience may make it easier for children with Spanish as their primary language to improve their English proficiency is the doubling of the English proficiency rate for Spanish-primary Head Start children in Cohort 2001 as they moved from kindergarten (when 14.7 percent were English proficient) to first grade in 2002 (when 28.7 percent were proficient).

The importance of becoming proficient in English by about grade 4 was shown in section I (Table 1.5): children whose English remains limited after fourth grade were much more likely to be placed in special education. The better data on English proficiency that became available in 2000-2001 makes it important to continue tracking Cohorts 2001 and 2002 as the children move on toward fourth grade. If higher percentages of non-English proficient children from the preschool programs than from the comparison groups acquire full proficiency between kindergarten and the later grades, then this would be evidence of a major contribution by the preschool program. Improved English proficiency seems to be the first step in a sequence leading to improved school success, and on from there to better reading and mathematics performance.

**Table 2.11. Percent of children with full English proficiency in APS kindergarten and first grade, by primary language spoken on entering preschool, for ACDC and Head Start.**

Children entering kindergarten in:	Primary language in preschool	Full English proficiency in:		N
		2001	2002	
2000-2001				
Head Start	English	82.0	89.1	448
	Spanish	14.7	28.7	101
2001-2002				
ACDC	English		86.7	113
	Spanish		33.3	27
Head Start	English		85.4	479
	Spanish		26.1	138

**Multivariate analysis of KDPR Proficiency with School Success, English Proficiency, and Ethnicity introduced as possible mediating variables**

The logistic regression model shown in Table 2.6 estimated the effects of family income (Reduced Price vs. Free lunch support) and pre-kindergarten experience (represented by two “stacked” dummy variables, ACDC/Preschool and Preschool/No Preschool) on 2001 and 2002 KDPR proficiency. In the Phase 1 study it was found that controlling for special education accounted for (reduced) the effect of preschool experience substantially, suggesting that because preschool experience kept children out of special education, and special education placement was associated with lower achievement test scores, the improved performance of preschool students during the later elementary years was partially explained by their not needing placement in special education. Table 2.12 continues that analytic approach, introducing into the logistic model three variables known to be related to achievement test scores: Special Education, English Proficiency, and Hispanic ethnicity.

**Table 2.12. Logistic regression analysis estimating the effects of ACDC, Preschool, and Lunch Support status on proficiency (vs. non-proficiency) on the 2001 and 2002 KDPR.**

Dependent variables:	2001 KDPR Total		2002 KDPR Language		2002 KDPR Math	
Independent variables:	B	Significance	B	Significance	B	Significance
<i>Core variables:</i>						
ACDC vs. Preschool	.089	.750	.200	.316	.377	.090
Preschool vs. No Preschool	.229	.008	.295	.001	.206	.020
Reduced Price vs. Free Lunch	.414	.000	.525	.000	.472	.000
<i>Add special education:</i>						
ACDC vs. Preschool	-.007	.981	.229	.256	.415	.065
Preschool vs. No Preschool	.241	.007	.284	.001	.194	.029
Reduced Price vs. Free Lunch	.411	.001	.540	.000	.488	.000
Special Education/School Success*	1.937	.000	1.169	.000	1.026	.000
<i>Add English proficiency:</i>						
ACDC vs. Preschool	.023	.935	.172	.400	.359	.110
Preschool vs. No Preschool	.164	.060	.177	.047	.115	.201
Reduced Price vs. Free Lunch	.312	.009	.330	.008	.323	.016
English proficiency	.594	.000	1.032	.000	.724	.000
<i>Add Hispanic ethnicity:</i>						
ACDC vs. Preschool	.090	.746	.217	.277	.385	.083
Preschool vs. No Preschool	.229	.008	.288	.001	.202	.022
Reduced Price vs. Free Lunch	.416	.000	.484	.000	.450	.001
Hispanic ethnicity	.285	.025	.426	.000	.109	.386
<i>Add all variables together:</i>						
ACDC vs. Preschool	.090	.784	.362	.103	.273	.249
Preschool vs. No Preschool	.175	.067	.090	.345	.070	.467
Reduced Price vs. Free Lunch	.280	.036	.261	.051	.260	.067
Special Education*	1.947	.000	1.256	.000	1.017	.000
English proficiency	.642	.000	1.084	.000	.831	.000
Hispanic ethnicity	.157	.256	.126	.335	-.137	.317

\* For Cohorts 2000 and 2002, Special Education placement was used by itself; for Cohort 2001, Grade Retention was added to Special Education in the constructed variable School Success.

The first step in reading Table 2.12 is to look at the size of the effect estimates (B coefficients) when each new variable is first added to the core of previous variables, and the second step is to see how much the effects of ACDC/Preschool (henceforth, ACDC) and Preschool/No Preschool (henceforth, Preschool) are reduced by the inclusion of each new variable.

- The effects of special education are large, especially when combined with grade retention for Cohort 2001 in the constructed variable School Success. Controlling for School Success for Cohort 2001 reduces the effects of ACDC to, essentially, zero, but increases the effect of Preschool for this cohort. Here we have evidence that the success of ACDC in preventing grade retention was a major contributor to the superior KDPR scores in 2001. For the 2002 KDPR's, controlling for special education (by necessity without controlling for grade

retention) actually increases the effects of ACDC while slightly decreasing the effects of Preschool. Since children in special education during kindergarten are those with clear physical or cognitive disabilities, it appears that the effects of ACDC are brought into sharper focus when the analysis looks separately at “normal” children and at children with disabilities.

- English Proficiency also has large, and highly significant, effects on KDPR scores, although not as large as special education and grade retention. But introducing English Proficiency into the model consistently reduces the effects of both ACDC and Preschool, implying that the proportionately higher percentages of children from these programs who are English proficient in kindergarten explains part of the relative superiority of these groups on the KDPR. Another reasonable explanation is that the items on the Pre-LAS instrument used to measure English proficiency are somewhat similar to those used on the KDPR to assess language development in general. The KDPR is given in both English and Spanish versions, so it is possible that a child’s level of underlying cognitive development is showing up in both measures. In other words, it may be not the superior English proficiency of ACDC (and to a lesser extent, Preschool) children that causes them to score well on the KDPR, but the fact that by kindergarten these children have more fully developed the cognitive skills necessary to perform well on either the English KDPR, the Spanish KDPR, or the Pre-LAS. If so, then credit for the cognitive development should go to ACDC and, to a lesser extent, the other preschool programs. To resolve this issue in the future, we will need better measures of English proficiency at the time the children first enter preschool, at age 3 or 4.
- Other ethnic groups besides Hispanics tend to score lower on achievement tests, but their numbers are so small that here we simply restrict the analysis to Anglo vs. Hispanic. One reason for introducing the variable “Hispanic” into the model is to sort out the effects of Hispanic ethnicity from the effects of limited English proficiency. Almost all Anglo kindergartners score proficient in English (98 percent), but so do most Hispanics (68 percent). Adding Hispanic to the model by itself shows strong effects on KDPR language proficiency, but much smaller effects on KDPR math proficiency, which implies a language problem rather a cognitive development problem (note that the effect on the 2001 KDPR total, which combines language and math, falls right in between the two 2002 scores).
- Finally, when Special Education, English Proficiency, and Hispanic ethnicity are all simultaneously introduced into the model, the effects of the former two remain high while the effects of Hispanic ethnicity drop substantially. The most obvious explanation is that Hispanic ethnicity by itself has little effect on KDPR language scores, but that the limited English proficiency of a substantial minority of Hispanic kindergartners has a strong effect, resulting in lower KDPR scores. Again, as noted above, it is possible that similarities in the underlying structure of the KDPR and the Pre-LAS account for some of this result. Although the finding should therefore be treated as tentative pending further investigation, it’s potential importance cannot be minimized.
- The primary purpose of this analysis was to see if introducing the three possible mediating variables, one at a time and then in combination, would reduce the initial effects of ACDC and Preschool and thus suggest explanations for how preschool programs produce their positive effects. Looking across all five models shown in Table 2.12, the interesting pattern that emerges is that B coefficients for ACDC show no consistent decline when any or all of the control variables are introduced, but the Preschool coefficients all decrease (and for the two 2002 KDPR measures, are reduced to about one fourth of their initial value. For

Preschool, the mediating variable most responsible for this is English Proficiency—introducing English Proficiency by itself reduces the positive effects of being in a preschool program other than ACDC by almost half.

All of this suggests two conclusions:

1. The positive effects of ACDC, relative to other preschool programs, may be partially explained by Grade Retention, but are not explained in grades K-2 by special education, English proficiency, or Hispanic ethnicity. The implication, therefore, is that the contributions of ACDC stem primarily from the success of the program in helping develop the cognitive skills that children need to be proficient on the KDPR tests.
2. The positive effects of other preschool programs, relative to children who did not attend preschool, appear to be partially explained by the superior English proficiency of preschool children when they arrive in kindergarten. The superior English proficiency may have been caused by the preschool program, but the findings on this are not yet clear. With English proficiency and the other variables controlled, non-ACDC public preschools make a modest but consistent contribution to improved KDPR scores for their graduates.

The second conclusion deserves elaboration. In general, children who are proficient in English do better on the KDPR. Preschool children are more likely to be English proficient than No Preschool children, so overall Preschool children score better on the KDPR than No Preschool children. But when only children who are English proficient are compared, the advantage of Preschool children on KDPR tests is decreased (and similarly, when only children who are not English proficient are compared). Presently, it is not possible to determine whether the superior English proficiency of preschool children stems from their developing improved English language skills during preschool, or is an ability the children already had at age 3 and just carried on through into kindergarten. If the latter, then we are returned to the challenges, noted earlier, of first making preschool programs more available for children with limited English proficiency, and second, of actively recruiting those children to enroll in the programs.

### **Analysis of Data on Children's Backgrounds and Experiences in Preschool**

Table 2.11 included data on the primary language of the child at time of enrollment in preschool. This section will examine other information collected by Head Start on the child's career in preschool (for the time period covered in this report information of this kind was available only on Head Start children, because the Head Start database system went into full operation earlier and therefore provides more complete information on the cohorts under study). As database systems improve, for ACDC as well as Head Start, it will be possible to begin identifying characteristics of preschools that contribute to improved functioning, in general and for particular kinds of students. The information presently available is somewhat limited, but allows preliminary analysis to begin on several important questions.

Effects of length of time in Head Start on outcome measures. First, using this additional information we were able to classify Head Start children according to how long they actually spent in the program. The Head Start students shown in Table 2.13 include some who left the program after a few days or weeks, and others who were exposed to two full years of Head Start's child development program. This table breaks the Head Start children in each cohort into three categories: less than one full year in the program, one full year but less than two, and two full years.

Beginning with Cohort 2003 the same distinctions will be possible for ACDC children. This is important because, as Table 2.13 shows, children with more exposure to Head Start are, overall, more successful as they proceed through APS. The greater success of children who spent more time in Head Start shows up particularly strongly for grade retention, suggested earlier to be probably the best indicator of early school success. As noted, Head Start includes by mandate a large number of children with disabilities. Some of these disabilities are not easily treated, and when these children enter APS they are soon placed in special education programs. This results in special education rates for Head Start that are caused more by the initial disabilities than by subsequent lack of school success. For this reason, grade retention is a better indicator of the true effects of Head Start in making possible school success. The conclusion then is that for both Cohorts 2000 and 2001, children who stayed in Head Start for at least one year were considerably less likely to be held in the same grade for another year than those who did not complete their first year.

**Table 2.13. Percent of children with different levels of exposure to Head Start who were a) in Special Education during Spring 2000, 2001, or 2002, b) retained in grade at some time, and c) either in special education or retained in grade (“Problems with school success”) by 2002.**

Head Start children entering APS kindergarten in:	a) Placed in Special Education during:			b) Retained in grade by or before 2002	c) Problems with school success by 2002	N 2002
	2000	2001	2002			
<i>Cohort 2000</i>						
Less than 1 year	7.5	17.0	19.6	15.1	26.4	53
1 or 1+ years	7.4	12.3	17.9	8.2	22.5	231
2 full years	4.1	7.6	12.8	7.5	17.7	147
<i>Cohort 2001</i>						
Less than 1 year		3.5	5.8	5.8	11.6	86
1 or 1+ years		6.1	11.6	1.7	12.5	296
2 full years		7.4	10.3	1.7	11.4	175
<i>Cohort 2002</i>						
Less than 1 year			5.7			157
1 or 1+ years			5.0			323
2 full years			6.3			205

The additional data available for Head Start students allows doing for KDPR scores what was done in Table 2.13 for school success measures. For Head Start children only, Table 2.14 compares KDPR language and math scores for children who were enrolled in the program for varying amounts of time. In all cases children who experienced two full years of Head Start performed better than the others, and in almost all cases those with one year (but less than two) performed better than those who had less than one year. The pattern for achievement scores therefore differs from the pattern for grade retention and school success in finding consistent advantages to being in Head Start for two years rather than one. This is an important difference, because it tends to rule out a possible source of bias. Parents of children who enroll with Head Start but drop out during the first year may be less motivated and less concerned about their children’s educational future, which would introduce a selection bias between the groups. Whether a child is in Head Start for one or two years depends primarily on whether there were enough openings when the child was three years old—children who could not be admitted that year have to wait until they are four, but there is no obvious way in which selection bias could be introduced through this process. Therefore, the trends support the contention that the more exposure to Head Start, the better the outcomes for the child.

**Table 2.14. Percent of Head Start children entering APS kindergarten in Cohorts 2000, 2001, and 2002 who scored “Proficient” on the KDPR and Grade 1 Reading Assessments, and Grade 2 Reading Assessments for Cohort 2002. Different versions of the KDPR were used during different years. No grade 1 reading assessment was given Spring 2002.**

Head Start children entering APS kindergarten in:	Kindergarten:		Grade 1	Grade 2 reading:		N
	Proficient on KDPR:		Reading	% below	Mean grade	
Cohort 2000	Language	Math	Total	grade level	level	
Less than 1 year	28.9%	28.6%	35.9%	33.3%	2.2	33
1 or 1+ years	42.0%	35.3%	36.8%	39.0%	2.1	182
2 full years	44.5%	45.2%	37.5%	25.6%	2.4	120
Cohort 2001	Total					
Less than 1 year	46.5%					86
1 or 1+ years	39.2%					293
2 full years	52.0%					175
Cohort 2002	Language	Math				
Less than 1 year	40.9%	57.7%				149
1 or 1+ years	40.8%	62.7%				311
2 full years	49.3%	67.3%				205

Effects of parents’ education on outcome measures. Comprehensive data on parents’ education were also available for Head Start children, and this allows a preliminary assessment of the importance of parents’ education in our sample of children from poor families. Table 2.15 shows that for Head Start children, parents’ education is consistently associated with proficiency on the KDPR. While there is little difference between children whose parents had nine years or less of school and those who attended high schools but did not graduate, the large group of children whose parents graduated from high school performed substantially better. Children whose parents had attended college or vocational school did the best of all, although this is a relatively small group. In sum, the higher the education of the parents, the better the KDPR performance of the children. This is not surprising, but shows that parental education is an important factor within the population of low-income families whose children are eligible for Head Start. As better data become available in the future, it will be desirable to control for parents’ education.

**Table 2.15. Parents’ education by percent of Head Start children entering APS kindergarten in Cohorts 2001 and 2002 who scored “Proficient” on the KDPR.**

Parent's education:	Mean KDPR scores for children entering APS kindergarten during				
	Cohort 2001		Cohort 2002		
	Total score	N	Language	Math	N
Ninth grade or less	36.3	91	36.3	59.3	91
Some high school	37.5	128	37.5	57.0	128
High school grad or GED	45.3	274	45.3	65.3	274
Some college or TVI	55.4	92	55.4	72.8	92

Effects of family income on outcome measures. Reasonably complete data on household income were also available for Head Start children, but only for Cohorts 2000 and 2002 – for some reason income data for Cohort 2001 were incomplete. Eligibility for Head Start is based on a combination of household size and household income. For a family of four in 2000 the poverty line was about \$16,700, which means that most of the Head Start families shown in Table 2.16 to be earning more than \$17,000 had children with disabilities, a category that overrides other criteria. This is important

for interpreting the figures in Table 2.16. Although the children with family incomes above \$17,000 do less well on the KDPR than other children, this is almost certainly because many of them have disabilities which inhibit their performance. For the rest of the Head Start children in Cohorts 2000 and 2002, it makes no difference whether family income is near the poverty line or well below it (we chose \$14,000 as an arbitrary cutting point).

**Table 2.16. Household income by mean scores for Head Start children in APS kindergarten. KDPR total for cohort entering during 2000-2002, and language and math subscales for children entering 2001-2002.**

	Kindergarten		Grade 1	Grade 2		N
	Language score	Math score	Reading score	% Below grade level	Reading level	
Cohort 2000						
\$0 thru \$14,000	41.8%	38.1%	37.6%	32.6%	2.24	287
\$14,001 thru \$16,999	37.9%	38.9%	30.9%	39.6%	2.17	48
\$17,000 thru highest	41.3%	38.2%	36.6%	33.6%	2.23	335
Cohort 2002						
\$0 thru \$14,000	45.7%	63.0%				473
\$14,001 thru \$16,999	46.6%	75.9%				58
\$17,000 thru highest	32.9%	61.0%				82

An important finding that emerges from these last two tables. While parental education (particularly the distinction between parents who graduate from high school and those with lower levels of education) makes a lot of difference in this low-income Head Start population, a similar distinction between those with what might be called “high poverty” incomes and those with “low poverty” incomes has essentially no relationship with the performance of their children on early achievement assessments.

### III. SUMMARY AND CONCLUSIONS

The research reported here, Phase 2 of an ongoing project, had two purposes: First, to follow the children from Phase 1, who were in grades 1-6 in Spring 2000, through two more years of APS. Second, to begin tracking three new cohorts—children who entered APS kindergarten in the school years 1999-2000, 2000-2001, and 2001-2002. The work on these two tasks was reported in Sections I and II, respectively. Several important findings emerged:

Special Education. Children who attend a preschool program are less likely to be placed in special education programs than children who do not. However, this is a gradual process, beginning in first grade and continuing until at least fifth grade. The Phase 1 research, which could not track cohorts of children over time, found a sharp difference between children in grades 1-3 and children in grades 4-6. This sharp jump seems to have been simply the result of random variation: the children who happened to be in grades 3 and 4 in Spring 2000 were just different from each other. The actual difference between the rates at which preschool and non-preschool children are placed in special education depends on the preschool (ACDC children appear to have the lowest rate of special education placement) and on the comparison group. Using for comparison the group of all children receiving Free Lunch support who did not attend a preschool, the special education rates for preschool children appeared to be two-to-three percent per year lower. If that trend begins in kindergarten, by fifth grade there would be a ten-to-fifteen percentage-point difference in favor of the preschools. However, because the time span available for analysis was only two years, this kind of extrapolation is still tentative.

Data for children entering kindergarten in 1999-2000, 2000-2001, and 2001-2002 were even more limited for tracking purposes, because while the 1999-2000 cohort could be followed for two years, the 2000-2001 cohort had advanced only one year by the close of the Phase 2 study in Spring 2000, and the 2001-2002 cohort had just entered kindergarten. Nevertheless, the findings here contribute to the emerging picture. First, it appears that for the very early grades (K-2), retention in grade is a better indicator than special education that the child is not progressing satisfactorily with the mainstream of classroom teaching. Grade retention is particularly common between kindergarten and first grade, and here the difference between ACDC and the no-preschool, Free Lunch comparison groups was over four percent. Therefore, the conclusion from both parts of the Phase 2 study is that the children who attended preschools, especially ACDC, experience over the long-term an increased likelihood of staying in mainstream classroom education, not being held and not requiring special education programs.

Language and math achievement. In Phase 1 there was essentially no difference between the reading achievement scores of preschool and comparison children in grades 1-3, although reading advantages for the preschool group appeared in grades 4-6 as more and more of the comparison children were placed in special education. Tracking these children through two more years of school found no changes in this pattern. The failure of the Phase 1 study to find any difference between preschool and comparison children in first and second grades indicated considerable room for improvement, however. Many follow-up studies of preschool programs have found their children to be doing significantly better than comparison children.

It was a very positive development, then, that Phase 2 found slight advantages for ACDC children in the 1999-2000 cohort in reading and math performance, and large and significant advantages for

ACDC children in the 2000-2001 and 2001-2002 cohorts. This pattern suggests a gradual but successful improvement in cognitive development components of the ACDC program. More ACDC children scored “Proficient” on the KDPR language assessment (54.4 percent) than children from other public preschools (48.0 percent), who in turn scored better than non-preschool children receiving Free Lunch support (41.0 percent). Furthermore, ACDC children scored slightly higher than non-preschool children receiving Reduced Price lunch support (52.3 percent). In fact, ACDC children in 2002 were rated proficient in language at a rate only seven percentage points below the highest income non-preschool group, children receiving no lunch support at all. The purpose of public preschools is to help children from low-income families enter kindergarten on the same level with children from middle-class families, so a good argument can be made for using the Reduced Price Lunch children as a target group to be matched or surpassed. ACDC appears to be meeting this challenge.

Considerable analysis was devoted to critically understanding why the data show that ACDC (and to a lesser extent the other public preschool programs) makes apparent contributions to the development of language and math skills. Could this be an artifact that is really accounted for by other factors? For example, it is possible that the kinds of families who send their children to preschools are different from those who do not. These parents may be more concerned about helping their children to do well in school; research shows that children from such families are more likely to succeed. The best answer here is that parents who sent their children to ACDC were probably not different from those who sent their children to other preschools (most likely all these families were equally concerned about helping their children succeed). So the superior performance of ACDC children relative to children from other public preschools seems solid, although the superior performance of the other preschool children relative to non-preschool children could reflect differences in parents’ motivations (as well as other factors).

To explore these questions in more detail, a multivariate logistic regression analysis was carried out which looked at more specific categories of pre-kindergarten experience, family income as reflected in lunch support status, and several other variables. Two major findings emerged from this analysis:

1. The higher language scores of ACDC children relative to other preschool children in kindergarten are somewhat reduced when lunch support status is controlled, which reflects the fact that family incomes up to 175 percent of poverty are eligible for ACDC while Head Start, for example, (the largest of the other public preschools) is limited to 100 percent of poverty. This means that part of the advantage of ACDC over other preschools occurs simply because ACDC recruits children from families with slightly higher incomes. However, the remaining, substantial, advantage of ACDC over other preschools is not reduced when special education, English proficiency, and Hispanic ethnicity are controlled. This implies that the positive effects of ACDC apply directly to development of the cognitive abilities that the kindergarten language tests assess.
2. The higher language scores of preschool children relative to children who did not attend a preschool appear to be partially explained by the superior English proficiency of preschool children when they arrive in kindergarten. When both English proficiency and Hispanic ethnicity are controlled, the effects of Hispanic ethnicity almost disappear, suggesting that the problem is English proficiency rather than ethnicity. Furthermore, English proficiency is strongly related not only to the KDPR language assessment (given in both Spanish and English versions), but also to superior performance on the math assessment.

It becomes quite important, therefore, to understand why children from ACDC and other preschools arrive in kindergarten considerably more likely to be proficient in English than children who did not attend a preschool. One answer may be that the preschools contribute to this proficiency by helping their children improve their English skills. But it is also possible that children who are proficient in English are more likely to enroll in a preschool. This would include Hispanic children--the majority of Hispanic children are proficient in English when they enter kindergarten, and those who are English proficient are considerably more likely to have attended a preschool than those who are not. The second answer, therefore, is that Albuquerque preschools may not be doing a good enough job of recruiting and enrolling children whose primary language is not English (although there are some preschool programs, like Even Start, that specifically target non-English speakers). Probably both of these answers apply, and in future phases of this research we hope to be able to distinguish between them.