Parent/caregiver involvement in activities with children and child language, school readiness, and social-emotional outcomes in a high quality early learning program

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A thesis submitted in partial fulfillment of the
requirements for the degree of

Master of Public Health

University of Washington
2017

Committee:
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Program Authorized to Offer Degree:
Department of Health Services

University of Washington

Abstract

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Background: While there is evidence that suggests parent/caregiver involvement in activities with children can narrow the academic achievement gap for school-aged children across socioeconomic lines, there is much less research on this topic for early childhood.

Methods: The objectives of this study were to: (1) Measure the association between parent/caregiver involvement and child vocabulary, language, school readiness, and social-emotional outcomes; and (2): measure the association between parent/caregiver involvement and length of time in the program. This was a cross-sectional study using data from the Educare Implementation Study (N=2469), which follows children (0-5 years of age) and families in Educare, a high-quality early learning program. Controlling for various covariates, we estimated the mean difference and 95% confidence intervals in outcome scores among different parent/caregiver involvement levels using multiple linear regression.

Results: Compared to a baseline of "3-5 times" engagement in a particular activity in the past week, higher levels of parent/caregiver involvement in activities with children was generally associated with higher outcome scores though only certain activities were significantly associated when considering each type of activity. Certain activities had a threshold effect while others showed a more gradient-based relationship. Reading and items related to talking, regardless of content were significantly associated with higher scores across all outcomes. For social-emotional protective factors, items indicative of parent-child relationship, such as singing and doing arts and crafts were also shown to be important, though all had a threshold-based relationship where no involvement at all was associated with significantly lower scores. Compared to a baseline of 2 years, less time in the program was significantly associated with lower average parent/caregiver involvement: 1 year or less (-0.17: 95% CI: -0.26, -0.08) and 2 years or less (-0.10; 95% CI: -0.18, -0.02).

Conclusions: Particular parent/caregiver involvement activities were associated with better child outcomes. These data suggest that parent/caregiver involvement has potential to narrow the achievement gap even beyond participation in a high early learning program and the length of time in a high-quality early learning program may impact parent involvement.

Acknowledgement:

The author acknowledges funding for this work from the U.S. Department of Health and Human Services, Health Resources and Services Administration's Maternal and Child Health Bureau (Title V, Social Security Act), grant #T76MC00011.

Table of Contents

INTRODUCTION

Policy-makers, researchers, and educators have been grappling with various strategies to narrow the academic achievement gap. The latest Census revealed that in the U.S., more than 1 in 5 children grow up in poverty[1]. Children from socio-economically disadvantaged backgrounds are more likely to fall behind their peers in education attainment, leading to disparities in achievement and health outcomes for populations with higher rates of poverty, such as Blacks/African Americans, Hispanics, and American Indians.[2,3] As income inequality continues to widen, so too does the achievement gap appear to worsen over the last 4 decades.[4] Not only is education linked to higher job opportunity and incomes, there is a persistent association between education and health.[5–7] Those with higher levels of education have lower morbidity in a wide range of both chronic and acute conditions.[6]

Research indicates, however, that the impact of poverty on child outcomes can be reduced through targeted intervention, one of which is high-quality early childhood education.[2] While the school setting is often used for many interventions, an increasingly robust body of research points to the importance of parent involvement in student achievement. Meta-synthesis research on the effects of parent involvement on the academic success of school-aged children (K-12), for example, show that increased parent involvement can lead to greater academic success even across racial and socio-economic lines[8]. More recent research on pre-school children suggest that high parent involvement can also be a critical component for children's academic achievement at an even earlier age[9–11], though research in this area is much less abundant for early childhood than for school-aged children. Involvement during early childhood is likely to show even greater effects, given that this is the most critical period of brain development[12,13].

A study done by Fantuzzo et al.[9] showed that of all the different types of parent involvement, the most important for predicting child outcomes is home-based involvement. However, most research studies I this area discuss the importance of parental home-based involvement but do not explicitly examine which activities lead to the most gains and how often these activities actually need to be performed to see

differences in results. In addition, there is some conflicting evidence on the relationship between participation in an early learning program and parental involvement. The National Institute for Early Education Research released a study that raised concerns around parental reliance on early childhood programs to provide formal early learning. The study saw increased levels of parent expectations for child school readiness but no changes in levels of family activities to support such skills[14]. Another study released by the National Bureau of Economic Research, however, showed that families enrolled in Head Start programs do increase the level of home activities to support children's learning when looking at levels of involvement during and after the program[10].

Given the paucity of literature on parent/caregiver home-based involvement during early childhood and the potential effect participation in a high-quality early learning program, our study sought to examine the relationship between selected parent/caregiver activities with children and specific child outcomes in a population of low-income pre-K children ages 4-5 by looking at differences in outcomes based on different levels of parent/caregiver involvement. It also sought to measure the association between length of time in a high-quality early childhood program and frequency of home-based parent/caregiver involvement.

Primary aim: Measure the association between parent/caregiver involvement in home-based activities with children and child performance on assessments for vocabulary, language, school readiness, and social-emotional protective factors at the time children leave the early learning program.

Secondary aim: Measure the association between program dosage (how long the child has been exposed to the early learning program) and parent/caregiver involvement.

We hypothesized that parent/caregiver involvement is associated with better child outcomes on all measures and that higher levels of involvement leads to better assessment scores. We also hypothesized that higher program dosage is associated with higher parent/caregiver involvement.

METHODS

Study design and data source

The study population consists of low income, pre-K children between 4-5 years of age who were enrolled in the Educare Implementation Study. We used a cross-sectional design with data taken from the Educare Implementation Study, a national sample of low-income children in a high-quality early childhood program serving children from birth to 5 years of age. The Educare Implementation Study has been tracking child and family outcomes since 2005 with 21 schools currently participating in the Educare Learning Network located in both urban and rural settings. Approximately 90% of children in the program have minority backgrounds and a third are dual-language learners[15]. Families and children consented into the Implementation Study are followed over time. Families are asked to participate in the study during their enrollment period and children consented into the study are given assessments throughout their time in the program that look at a variety of child school readiness outcomes. Family outcomes are tracked via annual interviews that asks about many family-related factors such as parent/caregiver involvement with children, depression, family structure, homelessness, and food insecurity.

Study Subjects

Eligibility for inclusion in the study sample depended on availability of exposure information (has an exit interview) and outcome information (has at least one of the child assessments of interest) beginning from the 2012-2013 school year. The sample contains only children who have assessments during the spring assessment period before their leave for kindergarten. Thus, this represents their last assessment period before they exit the program, which is the same time period during which families are given a final exit interview. Interviews are conducted by family advocate staff and usually done with the primary caregiver of the child, though in some cases, families can fill out the interview as a survey. The final sample contains only children who have an exit interview and at least one of the child assessments of interest

completed during the spring semester before the child's exit for kindergarten. Thus, all children were between 4-5 years of age. The sample contained 2,469 students eligible for analyses based on these criteria.

Exposure

Parent/caregiver involvement in activities with children was assessed by response to 13 questions related to parent/caregiver involvement in activities taken from the family exit interview. These questions were adapted from the Head Start FACES study[16]. The 13 items ask about the frequency of parent or other caregiver involvement in activities with children in the past week. These activities include reading to children, telling stories, singing songs, playing games, teaching words and numbers, playing sports, and a number of other activities (please see Appendix A for complete list). The intensity of involvement is measured by frequency of occurrence on a 4-point Likert scale (none, 1-2 times, 3-5 times, 6-7 times). An answer of "none" was coded as 0, "1-2 times" was coded as 1, "3-5 times" was coded as 2, and "6-7" times was coded as 3. Analyses were done with each of the 13 items treated as an individual exposure as well as combined together as an average parent/caregiver involvement score calculated as the sum of scores for each item (0-3) divided by 13 (total number of items).

To examine the effect of program "dosage", we used the length of time a child was in the program based on their official enrollment and exit dates (years).

Outcomes

Research on child academic outcomes use a variety of child measurements that are usually direct observation or standardized norm-referenced assessments examining outcomes in language, vocabulary, school-readiness concepts, and social-emotional protective factors. Our child outcome measures were based on four different assessments: the Peabody Picture Vocabulary Test 4th Edition (PPVT-4)[17], the

English version of the Preschool Language Scale 5th Edition (PLS-5)[18], the Bracken School Readiness Assessment 3rd Edition (BSRA-3)[19], and the Devereaux Early Childhood Assessment (DECA)[20]. These measures respectively look at English receptive vocabulary, English language skills, school readiness, and social-emotional protective factors. The PPVT-4 standard score was used as the outcome measure for vocabulary. The PLS-5 total standard score for the English version was used as the outcome measure for language and is the cumulative score for two separate sections: auditory comprehension and expressive communication (verbal ability). It has both an English and a Spanish version, but for the purposes of this study, only those who were given both sections of the PLS-5 *English* version were included. The BSRA-3 total standard score was used as the outcome measure for school readiness. The BSRA-3 contains five subtests looking at basic school-readiness-related concepts: colors, letters, numbers/counting, size/comparison, and shapes. For the PPVT-4, PLS-5, and BSRA-3, a standard score of 100 is considered 50th percentile, with one standard deviation equal to 15 points. The DECA total protective factors *T*-score was used as the outcome measure for social-emotional protective factors. The DECA is a teacher-reported measure and looks at within-child protective factors related to resiliency: initiation, attachment/relationships, and self-regulation. There is an additional behavioral concern score that is not included in the total score and therefore not included in analyses. A *T*-score of 50 is considered average.

Covariates

A priori –selected potential covariates included: child sex, child race, primary caregiver depression, dual-language learner status, child health, number of significant life events, family structure, primary caregiver relationship to child, teenage mother status, child individualized education plan status (disability), primary caregiver education level, and child attendance rate. We adjusted for variables which meaningfully (by 10%) changed the beta estimate of a given exposure as it relates to the outcome score. We considered the following characteristics ascertained as potential confounders for at least one of the

parent/caregiver involvement items: child race, dual-language learner status, child health, and primary caregiver education level. Potential effect modifiers were evaluated by inspection of stratum-specific mean difference estimates for important differences and resulting p-values (95% confidence level). We did not find any effect modifiers among the a priori-selected covariates, including length of time in the program.

Data Analysis

Multivariable linear regressions were conducted for the association between each parent/caregiver involvement activity (13 exposure items) and each assessment score (outcome), adjusting for relevant covariates. Differences in level of parent/caregiver involvement were compared to a baseline of involvement in an activity 3-5 times a week. Separate linear regressions were also conducted for the averaged involvement score and each of the four outcomes. Confounders found for vocabulary (PPVT-4) and school readiness (BSRA-3) included: child race, dual-language learner status, child health, and primary caregiver education status. Covariates for language (PLS-5) included child race, child health, and primary caregiver education status. Dual-language learner status was not found to be a confounder for the PLS-5, likely because there is a separate Spanish-version (which was not included in the analyses). Child race was the only covariate included for social-emotional protective factors (DECA). Multiple linear regression was also conducted for the association between averaged parent/caregiver involvement level and program dosage. All analyses were done using the R statistical software program, version 3.3.2 through the RStudio interface (version 1.0.143).

RESULTS

Mean standard PPVT-4, PLS-5, BRSA-3 scores were 93.1, 94.5, and 92.8 respectively. Mean DECA score was 52.3. Mean parent involvement score was 2.0. Child and family structure characteristics related to scores are shown in Table 1. PPVT-4 (vocabulary) scores were lowest for Hispanics, those with

two-parent family structures, lower primary caregiver education, poorer child health, food insecurity, and dual-language learners. PLS-5 (language) scores were lower for males, non-Whites, and those with lower primary caregiver education and teenage mothers. BRSA-3 (school readiness) scores were lowest for male children, Hispanics, dual-language learners, those who had teenage mothers, lower primary caregiver education, poorer child health, and food insecurity. DECA (social-emotional protective factors) scores were lowest in males and dual-language learners. Those with individualized education plans (disability) had lower scores for all four assessments. Parent involvement levels were lowest for Hispanics, dual-language learners, those with lower primary caregiver education, and poorer child health.

There were minimal missing exposure data (≤ 4.1% for all exposure items and 2.4% on average). Outcome data, however, had different distributions of certain demographic characteristics between groups that were missing and not missing outcome measures. For the PPVT-4 (vocabulary), children in the tested group were more likely to be Black/African American and less likely to be White. For the PLS-5 (language), there is a similar situation, with tested children were more likely to be Black/African American and less likely to be White or classified as “other”. In addition, the tested group was more likely to have single parent family structures, have better health, and be non-dual language learners as compared to non-tested children (this last factor is likely a result of the PLS-5 having a Spanish version). For the BSRA-3 (school readiness), tested children were more likely to be Black/African American, less likely to be White, and less likely to have significant life events as compared to non-tested children. For the DECA, tested children were more likely to be Black/African American and less likely to be White. Records with missing data were excluded from analysis.

Most families reported engaging in all 13 activities at least 3 times a week. When averaged, the most frequently reported activity was talking about what happened at school, followed by talking while doing everyday tasks/errands. The activity with lowest frequency is telling a story. When looking at individual items, items with highest frequency (6-7 times) are describing/narrating child experiences,

playing indoor games, talking while doing everyday task/errands, and talking about school. Please see Table 2 for reported frequencies of parent/caregiver involvement.

Tables 3-6 show results from the regression models on association between parent/caregiver involvement and child outcomes. Higher levels of parent/caregiver involvement in activities with children was generally associated with higher outcome scores in vocabulary, language, school readiness, and social-emotional protective factors, though only certain activities were significantly associated when considering each activity individually.

With respect to *vocabulary*, compared to a baseline of involvement in activities 3-5 times a week, increased involvement (6-7 times a week), was associated with significantly higher scores for reading (1.92) talking while doing everyday tasks/errands (2.02) and talking about school (1.79). Lower involvement (1-2 times) was significantly associated with lower scores for reading (-2.40) describing child's experiences (-2.31), and talking about school (-2.86). No involvement at all (none), was associated with particularly lower scores for telling stories (-4.49) and talking about T.V./video programs (-3.39). Thus, since the magnitude of difference at the "1-2 times" level was similar to that of scores at the baseline "3-5 times" and markedly lower for the "none" level, there seems to be a threshold effect for telling stories and talking about T.V./video programs. When considering parent/caregiver involvement as an averaged score, there is an estimated mean increase of 1.34 in vocabulary score for each 1-point increase in parent/caregiver involvement level.

With respect to *language*, increased involvement (6-7 times a week), was associated with significantly higher scores for talking while doing everyday tasks/errands (1.91) This was the only activity for which going beyond the baseline level of "3-5 times" showed a difference. Lower involvement (1-2 times a week) was significantly associated with lower scores for reading (-2.87), describing child's experiences (-2.79), and talking about school (-6.26). No involvement at all was associated with significantly lower scores for reading (-6.48), telling stories (-7.41), teaching words/letters/numbers (-10.94), and describing child's

experiences (-6.90). Since the magnitude of difference in scores for the "none" level compared to the "1-2" level is quite large, there seems to be a marked threshold effect for reading, storytelling, teaching words/letters/numbers, and describing child's experiences. In terms of magnitude of difference, not doing any of these things at all seems to lower scores by a large amount. When considering parent/caregiver involvement as an averaged score, the mean difference approaches significance (1.73; 95% PI: -0.10, 3.57; p = 0.06).

With respect to *school readiness*, higher involvement did not show significant difference in scores from the "3-5 times" baseline level. Lower involvement (1-2 times) was significantly associated with lower scores for reading (-2.60), describing child's experience (-2.11), and talking about school (-4.24). No involvement (none) was significantly associated with lower scores for storytelling (-4.78). When considering parent/caregiver involvement as an averaged score, the mean difference approaches significance (1.07; 95% CI: -0.05, 2.20); p = 0.06).

With respect to *social-emotional protective factors*, higher involvement did not show significant differences in scores from the "3-5 times" baseline level. Lower involvement (1-2 times) was significantly associated with lower scores for reading (-1.13) and teaching songs/music (-1.41). No involvement (none) was significantly associated with lower scores for teaching letters/words/numbers (-7.20), singing songs (-2.74), teaching songs/music (-2.97), doing arts/crafts (-3.54), and talking about school (-9.41). In terms of magnitude of difference, not teaching letters/words/numbers and talking about school seems to be of particular importance for lower scores. When considering parent/caregiver involvement as an averaged score, the mean difference is not significant.

Compared to a baseline of 2-3 years, less time in the program was significantly associated with lower average parent/caregiver involvement: 1 year or less (-0.17: 95% CI: -0.26, -0.08) and 2 years or less (-0.10; 95% CI: -0.18, -0.02). Each additional year of the program is significantly associated with an additional 0.03 points of average involvement (95% CI: 0.01, 0.05).

DISCUSSION

We found that home-based parent/caregiver involvement in activities with children was generally associated with higher outcome scores on receptive English vocabulary, English language skills, school readiness, and social-emotional protective factors. Some were of a threshold-based relationship while others had more of a gradient-based relationship. We also saw a higher level of involvement for families that have been in the program longer.

For vocabulary, language, and school readiness, the two main activities that were shown to be important across the board were reading and talking. The content of talk did not seem to matter, whether it was describing what children are experiencing, talking to children during everyday tasks and errands, talking about what happened at school, or talking about T.V. programs/videos. For certain activities, however, involvement more than 3-5 times a week did not show a significant difference. The importance of reading and talking on child academic outcomes is well-documented in the literature [21–25] and our study supports the notion that the more these activities are done, the higher child outcomes are likely to be along a linear gradient.

For social-emotional protective factors, the activities that were important were somewhat different from those for vocabulary, language, and school readiness. Reading was still important, but other activities such as teaching letter/swords/numbers, singing songs, teaching songs/music, doing arts/crafts, and talking about school was highly associated with lower outcomes, especially when these were reported as not being done at all within the past week. Given the large magnitude of difference from the "none" level to the "1-2" level in comparison with the difference between the "1-2" level and the "3-5" level, the relationship between social-emotional outcomes and parent/caregiver involvement activities seemed to be more of a threshold-based relationship as opposed to a gradient-based relationship. A potential confounder for the relationship between social-emotional protective factors and child outcomes is the level of parent-child conflict. Parent-

child dyads with relationship conflict are probably less likely to engage in these types of activities at all and so social-emotional scores are more likely to be lower as well.

These findings are based on correlation and should be taken with caution in applying to intervention efforts. The results cannot definitively conclude that certain activities only have to be done a certain number of times per week to achieve certain results. Given that the magnitude of differences is much larger between the baseline "3-5 times" level and not doing the activities at all ("none") as compared to the magnitude of difference between baseline level and doing activities slightly more often than the baseline ("6-7 times") or slightly less often than the baseline ("1-2 times"), framing the results around what could potentially happen to scores when activities are not done at all is likely to be a more useful interpretation for intervention purposes.

While we know that socio-economic status is correlated with the level of language exposure[24], of particularly interesting note are the covariates that were found for vocabulary, language and school readiness outcomes: race, dual language learner status, child health, and primary caregiver education level (with the exception of dual-language learner status for language). While it is expected that dual-language learners would have lower outcome scores for these three areas, it is interesting to consider why parent-involvement may be lower as well for these populations. It is possible that this observed difference may be a result of cultural influences on how frequently parents are engaged with children. For example, there may be cultural differences as to how appropriate it is to talk often or whether talking to adults is considered respectful. In thinking about how to enhance family engagement, intervention programs may want to target particular groups for encouragement of parent/caregiver involvement, but also consider the cultural implications behind language use and parent involvement levels.

There are several limitations of the study. Given the patterns of missingness for all of the outcome measures, selection bias cannot be ruled out. Parent/caregiver involvement was also based on self-report, and therefore open to and social desirability factors. Parents/caregivers were asked to report activities from

the last week, so recall bias may not be as much of an issue, but this may not be representative of average involvement levels. Generalizability is limited, as studies vary widely in their definition and conceptualization of parent involvement. Only those enrolled in the Educare program were included in the study, so results may only be generalizable to comparable populations. Parent/ caregiver involvement is narrowly defined by 13 specific home-based activities, so there may be many other types of parent engagement unaccounted for, especially ones that may be more common in other cultures. This is especially relevant considering the highly diverse population that the Educare early learning program serves. Explorative qualitative studies can help identify what other types of activities may be of importance.

These data suggest that parent/caregiver involvement in home-based activities with children has potential to narrow the achievement gap even further beyond participation in a high-quality early learning program. These findings are consistent with the body of literature on parent involvement among older school-aged children. The length of time in a high-quality early learning program is correlated with parent/caregiver involvement in activities with children, with a longer length of time associated with higher average levels of parent involvement. Given that no covariates were examined in this study, however, future studies should look at other potential confounders or effect modifiers, as it could be the case that parents who stay longer in the program have traits that make them also more likely to have higher parent involvement. For a stronger analysis, future studies should also examine whether the level of parent/caregiver involvement actually changes over time the longer children are in the program.

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Table 1. Outcomes and parent/caregiver involvement average by selected characteristics

Characteristics	PPVT-4		PLS-5		BRSA-3		DECA		Involvement Average
	N	**Mean**	**N**	**Mean**	**N**	**Mean**	**N**	**Mean**	
SEX									
Male	809	92.75	370	92.89	823	91.74	828	50.46	1.98
Female	729	93.55	315	96.38	733	93.90	735	54.46	1.95
RACE									
Black/African American	607	97.40	470	94.13	614	96.77	616	51.58	2.04
Hispanic	680	86.58	107	94.59	690	88.06	695	53.13	1.86
White	127	103.70	52	97.17	127	97.46	99	52.69	2.18
Other	124	97.35	56	94.86	125	94.22	125	51.34	1.96
FAMILY STRUCTURE									
One parent	721	95.66	398	94.77	729	94.20	731	51.97	1.99
Two parents	711	90.58	245	94.14	719	91.45	724	52.82	1.94
Other	34	96.56	21	95.76	35	95.06	35	50.40	2.01
PRIMARY CAREGIVER EDUCATION (yrs)									
8	112	81.34	12	86.00	112	83.44	113	51.76	1.70
10	244	86.54	51	92.18	247	86.95	249	52.05	1.81
12	361	91.97	149	93.92	368	91.54	369	52.75	1.97
13	482	97.81	286	95.13	489	96.23	490	52.18	2.06
14	127	99.20	81	95.31	128	97.20	128	52.17	2.09
16	107	96.95	65	96.17	106	99.71	107	52.70	1.94
18	27	94.22	16	94.06	27	94.44	28	51.39	2.03
20	5	95.40	5	87.60	5	101.6	5	58.40	1.76
LIFE EVENTS*									
0 to 5	1289	93.01	572	94.77	1303	92.84	1310	52.50	1.96
6 to 10	160	95.22	87	93.21	163	93.18	163	50.92	2.02
11 to 15	6	88.83	2	83.50	6	92.17	6	53.00	2.08
CHILD HEALTH*									
1	0	NA	0	NA	0	NA	0		
2	19	85.84	4	92.75	20	85.30	20	53.55	1.71
3	171	88.53	58	93.03	173	89.71	177	50.80	1.82
4	532	92.81	231	94.39	542	92.18	543	52.29	1.94
5	717	94.75	349	94.86	721	94.34	723	52.65	2.03
DEPRESSION*									
Yes	282	92.23	128	92.76	105	91.82	289	51.58	1.96
No	1178	93.42	534	94.94	1376	93.14	1195	52.48	1.97
FOOD INSECURITY									
Yes	636	91.34	265	93.51	642	91.11	642	51.61	1.94
No	819	94.62	395	95.25	830	94.25	837	52.83	1.98
TEEN BIRTH MOTHER									

	Yes	147	92.71	53	91.09	152	90.53	153	52.00	2.05
	No	1285	93.34	593	94.79	1297	93.28	1303	52.35	1.96
DUAL-LANGUAGE LEARNER										
	Yes	1146	84.27	659	92.07	1152	86.75	1157	53.36	1.79
	No	392	98.18	26	94.77	404	96.17	406	51.76	2.06
INDIVIDUALIZED EDUCATION PLAN (DIS)										
	Yes	158	86.14	50	85.78	158	85.56	161	48.00	1.90
	Never	1380	93.93	635	95.18	1398	93.57	1402	52.84	1.97

*The first reported values (based on the first interview ever given) were used for family structure and primary caregiver education level. Rounded mean values collected across all family interviews were used for significant life events, child health, and caregiver depression.

Table 2. Reported frequencies for parent/caregiver involvement items (exposures)

				Reported Frequency							
				None		1-2 times		3-5 times		6-7 times	
Activity	**N**	**Mean**	**SD**	**#**	**%**	**#**	**%**	**#**	**%**	**#**	**%**
Read	2431	1.89	0.78	60	2%	709	29%	1091	44%	571	23%
Tell stories	2409	1.73	0.87	165	7%	833	34%	906	37%	505	20%
Teach letters/words/numbers	2414	2.20	0.77	45	2%	390	16%	1029	42%	950	38%
Sing songs	2403	2.10	0.87	104	4%	496	20%	864	35%	939	38%
Describe child's experiences	2367	2.01	0.85	86	3%	588	24%	908	37%	785	32%
Teach song/music	2380	1.87	0.95	209	8%	616	25%	831	34%	724	29%
Arts/crafts	2426	1.84	0.84	131	5%	700	28%	1026	42%	569	23%
Play indoor games	2418	2.22	0.80	58	2%	384	16%	939	38%	1037	42%
Play sports	2406	1.95	0.85	114	5%	581	24%	1021	41%	690	28%
Talk while doing everyday tasks/errands	2425	2.29	0.78	48	2%	345	14%	896	36%	1136	46%
Talk about what happened at school	2422	2.37	0.69	25	1%	222	9%	1003	41%	1172	47%
Talk about TV programs/videos	2406	1.84	0.89	159	6%	691	28%	925	37%	631	26%
Play counting/number games	2429	1.90	0.86	143	6%	615	25%	1024	41%	647	26%

Abbreviations: SD= Standard deviation
Mean = average score from assigned point values: none = score of 0 points; 1-2 times = 1 point; 3-5 times = 2 points; 6-7 times = 3 points

Table 3. Adjusted and unadjusted mean difference estimates for the parent/caregiver involvement activities and PPVT-4 (vocabulary), as compared to a baseline level of 3-5 times.

Activity		PPVT-4 (Vocabulary)		
		None	**1-2 times**	**6-7 times**
		Mean Difference (95% CI)	**Mean Difference (95% CI)**	**Mean Difference (95% CI)**
Read	Crude	**-4.81 (-9.32, -0.31)**	**-4.35 (-6.10, -2.60)**	**3.22 (1.27, 5.16)**
	Adjusted*	-1.99 (-6.32, 2.34)	**-2.40 (-3.99, -0.80)**	**1.92 (0.13, 3.72)**
Tell stories	Crude	**-6.41 (-9.65, -3.18)**	-1.69 (-3.43, 0.06)	**2.80 (0.75, 4.84)**
	Adjusted*	**-4.49 (-7.53, -1.44)**	-0.59 (-2.17, 0.98)	1.40 (-0.48,3.27)
Teach letters/words/numbers	Crude	2.41 (-3.07, 7.90)	-1.28 (-3.50, 0.95)	**3.45 (1.80, 5.10)**
	Adjusted*	1.20 (-3.70, 6.09)	-0.34 (-2.35, 1.66)	1.24 (-0.29, 2.77)
Sing songs	Crude	-3.74 (-8.30, 0.83)	**-2.80 (-4.95,-0.64)**	**2.42 (0.74, 4.09)**
	Adjusted*	-2.50 (-6.72, 1.72)	-1.69 (-3.64, 0.26)	0.95 (-0.58, 2.48)
Describe child's experiences	Crude	**-5.58 (-9.38,-1.79)**	**-4.37 (-6.36, -2.37)**	**2.28 (0.55, 4.01)**
	Adjusted*	-2.70 (-6.26, 0.85)	**-2.31 (-4.16, -0.46)**	0.40 (-1.18, 1.98)
Teach song/music	Crude	-1.05 (-4.03, 1.93)	-0.70 (-2.74, 1.34)	0.94 (-0.85, 2.74)
	Adjusted*	-1.72 (-4.33, 0.89)	-0.10 (-1.90, 1.71)	0.56 (-1.11, 2.23)
Arts/crafts	Crude	-2.61 (-5.82, 0.61)	0.70 (-1.17, 2.56)	1.31 (-0.59, 3.21)
	Adjusted*	-1.43 (-4.18, 1.31)	0.96 (-0.74, 2.66)	0.52 (-1.19, 2.23)
Play indoor games	Crude	2.74 (-2.85, 8.33)	0.23 (-2.02, 2.48)	**2.80 (1.15, 4.46)**
	Adjusted*	2.44 (-2.85, 7.73)	0.22 (-1.79, 2.23)	1.05 (-0.48, 2.57)
Play sports	Crude	1.35 (-2.52, 5.21)	-0.53 (-2.43, 1.37)	-0.21 (-2.05, 1.63)
	Adjusted*	2.13 (-1.26, 5.52)	-0.70 (-2.39, 0.99)	-0.65 (-2.32, 1.01)
Talk while doing everyday tasks/errands	Crude	-2.62 (-7.03, 1.79)	-1.98 (-4.42, 0.46)	**3.73 (2.09, 5.38)**
	Adjusted*	-0.75 (-5.15, 3.66)	-0.55 (-2.76, 1.67)	**2.01 (0.52, 3.5)**
Talk about what happened at school	Crude	-5.62 (-16.29, 5.05)	**-4.19 (-6.81, -1.57)**	**2.03 (0.44, 3.62)**
	Adjusted*	-1.11 (-10.76, 8.55)	**-2.86 (-5.35, -0.36)**	**1.79 (0.35, 3.22)**
Talk about TV programs/videos	Crude	**-5.03 (-8.10, -1.95)**	-0.47 (-2.34, 1.41)	1.36 (-0.52, 3.25)
	Adjusted*	**-3.39 (-6.14, -0.63)**	-0.42 (-2.09, 1.25)	-0.26 (-2.02, 1.50)
Play counting/number games	Crude	1.03 (-2.12, 4.17)	-1.52 (-3.46, 0.42)	**2.12 (0.28, 3.96)**
	Adjusted*	0.57 (-2.16 , 3.30)	-0.21 (-1.96 , 1.54)	0.81 (-0.90 , 2.51)
AS AVERAGE	Crude	**4.06 (2.85, 5.26)**		
	Adjusted*	**1.34 (0.21, 2.47)**		

Abbreviations: CI = Confidence Interval
All regressions adjusted for child race, dual-language learner status, child health, and primary caregiver education
Values in bold are those that are significant at the 95% confidence level

Table 4. Adjusted and unadjusted mean difference estimates for the parent/caregiver involvement activities and PLS-5 (language), as compared to a baseline level of 3-5 times

Activity		PLS-5 (Language) None	1-2 times	6-7 times
		Mean Difference (95% CI)	**Mean Difference (95% CI)**	**Mean Difference (95% CI)**
Read	Crude	**-6.94 (-12.68, -1.19)**	**-3.17 (-5.38, -0.95)**	0.18 (-2.37, 2.73)
	Adjusted	**-6.48 (-12.35, -0.61)**	**-2.87 (-5.19, -0.56)**	0.09 (-2.59, 2.76)
Tell stories	Crude	**-7.25 (-12.09, -2.42)**	-1.38 (-3.61, 0.84)	2.26 (-0.26, 4.79)
	Adjusted	**-7.41 (-12.11, -2.70)**	-1.45 (-3.74, 0.84)	1.96 (-0.59, 4.50)
Teach letters/words/numbers	Crude	**-10.86 (-21.11, -0.61)**	0.22 (-3.01, 3.46)	0.51 (-1.54, 2.57)
	Adjusted	**-10.94 (-20.74, -1.15)**	0.21 (-3.13, 3.55)	0.41 (-1.71, 2.53)
Sing songs	Crude	-8.54 (-19.53, 2.45)	-0.40 (-3.24, 2.45)	-0.05 (-2.13, 2.03)
	Adjusted	-9.02 (-19.85, 1.81)	-0.37 (-3.32, 2.59)	-0.75 (-2.88, 1.38)
Describe child's experiences	Crude	**-5.62 (-10.32, -0.93)**	**-3.08 (-6.09, -0.06)**	0.82 (-1.27, 2.90)
	Adjusted	**-6.90 (-11.96, -1.83)**	**-2.79 (-5.94, 0.37)**	0.51 (-1.63, 2.65)
Teach song/music	Crude	-1.24 (-5.47, 3.00)	-0.05 (-2.81, 2.71)	-0.09 (-2.29, 2.12)
	Adjusted	-1.51 (-5.77, 2.75)	0.36 (-2.51, 3.24)	-0.08 (-2.40, 2.23)
Arts/crafts	Crude	-1.34 (-5.04, 2.36)	0.94 (-1.54, 3.43)	1.24 (-1.10, 3.57)
	Adjusted	-1.46 (-5.29, 2.37)	1.34 (-1.20, 3.88)	1.08 (-1.30, 3.47)
Play indoor games	Crude	2.52 (-5.08, 10.12)	2.04 (-1.02, 5.10)	1.73 (-0.40, 3.86)
	Adjusted	1.66 (-5.79, 9.13)	2.27 (-0.84, 5.38)	1.58 (-0.63, 3.78)
Play sports	Crude	0.93 (-3.63, 5.49)	**4.29 (1.82, 6.76)**	0.79 (-1.49, 3.08)
	Adjusted	0.99 (-3.61, 5.59)	**4.52 (2.01, 7.03)**	1.16 (-1.17, 3.49)
Talk while doing everyday tasks/errands	Crude	-3.85 (-12.91, 5.22)	0.98 (-2.64, 4.60)	**2.37 (0.33, 4.41)**
	Adjusted	-3.59 (-12.76, 5.59)	1.35 (-2.43, 5.14)	**1.91 (-0.21, 4.02)**
Talk about what happened at school	Crude	-6.41 (-26.51, 13.69)	**-6.59 (-10.41, -2.76)**	0.50 (-1.49, 2.49)
	Adjusted	-5.27 (-24.56, 14.02)	**-6.26 (-10.31, -2.20)**	0.16 (-1.90, 2.21)
Talk about TV programs/videos	Crude	-2.86 (-7.791, 2.08)	-0.40 (-3.00, 2.20)	1.35 (-0.86, 3.57)
	Adjusted	-2.43 (-7.53, 2.67)	-0.47 (-3.13, 2.20)	1.51 (-0.78, 3.799)
Play counting/number games	Crude	-0.49 (-5.97, 4.98)	2.18 (-0.56, 4.91)	0.99 (-1.15, 3.130)
	Adjusted	-0.51 (-5.91, 4.88)	2.26 (-0.50, 5.03)	0.93 (-1.25, 3.111)
AS AVERAGE	Crude	**2.00 (0.23, 3.78)**		
	Adjusted	1.73 (-0.10, 3.57)*		

Abbreviations: CI = Confidence Interval
All regressions adjusted for child race, child health, and primary caregiver education
Values in bold are those that are significant at the 95% confidence level
*Approaches significance

Table 5. Adjusted and unadjusted mean difference estimates for the parent/caregiver involvement activities and Bracken (school readiness), as compared to a baseline level of 3-5 times

Activity		BSRA-3 (School Readiness)		
		None	**1-2 times**	**6-7 times**
		Mean Difference (95% CI)	**Mean Difference (95% CI)**	**Mean Difference (95% CI)**
Read	Crude	-3.56 (-8.37, 1.24)	**-4.48 (-6.17, -2.79)**	0.51 (-1.384, 2.40)
	Adjusted	-1.63 (-6.72, 3.46)	**-2.60 (-4.22, -0.98)**	-0.43 (-2.266, 1.41)
Tell stories	Crude	**-6.30 (-9.52, -3.09)**	**-1.72 (-3.41,-0.04)**	0.37 (-1.593, 2.33)
	Adjusted	**-4.78 (-7.93, -1.63)**	-0.62 (-2.24, 1.00)	-0.79 (-2.671, 1.09)
Teach letters/words/numbers	Crude	1.31 (-4.84, 7.47)	**-2.32 (-4.56, -0.08)**	**2.68 (1.12, 4.24)**
	Adjusted	0.49 (-5.26, 6.24)	-1.25 (-3.38, 0.88)	1.20 (-0.32, 2.72)
Sing songs	Crude	**-5.42 (-9.40, -1.44)**	**-2.46 (-4.55, -0.37)**	0.61 (-1.02, 2.24)
	Adjusted	-3.48 (-7.57, 0.61)	-1.35 (-3.37, 0.67)	-0.35 (-1.89, 1.19)
Describe child's experiences	Crude	**-3.98 (-7.85, -0.10)**	**-4.00 (-5.90, -2.10)**	1.61 (-0.06, 3.28)
	Adjusted	-1.99 (-5.78, 1.79)	**-2.11 (-3.99, -0.23)**	0.22 (-1.36, 1.82)
Teach song/music	Crude	-1.43 (-4.37, 1.51)	0.48 (-1.49, 2.46)	1.28 (-0.44, 3.00)
	Adjusted	-1.78 (-4.62, 1.07)	1.35 (-0.50, 3.19)	1.24 (-0.41, 2.90)
Arts/crafts	Crude	-2.66 (-6.15, 0.84)	1.39 (-0.38, 3.15)	1.14 (-0.69, 2.97)
	Adjusted	-1.72 (-5.02, 1.59)	1.68 (0.00, 3.37)	0.58 (-1.15, 2.31)
Play indoor games	Crude	-1.89 (-6.74, 2.96)	0.91 (-1.32, 3.14)	**1.89 (0.30, 3.48)**
	Adjusted	-2.66 (-7.16, 1.84)	0.89 (-1.16, 2.93)	0.59 (-0.96, 2.16)
Play sports	Crude	0.034 (-3.31, 3.39)	0.74 (-1.16, 2.64)	-0.25 (-1.98, 1.47)
	Adjusted	0.62 (-2.56, 3.80)	0.71 (-1.04, 2.47)	-0.43 (-2.10, 1.24)
Talk while doing everyday tasks/errands	Crude	-4.60 (-10.28, 1.08)	-1.73 (-4.21, 0.75)	**2.41 (0.86, 3.96)**
	Adjusted	-3.12 (-8.91, 2.66)	-0.17 (-2.48, 2.14)	1.36 (-0.12, 2.85)
Talk about what happened at school	Crude	-10.31 (-20.93, 0.32	**-5.95 (-8.75, -3.15)**	1.05 (-0.48, 2.57)
	Adjusted	-7.38 (-17.39, 2.64)	**-4.24 (-6.87, -1.62)**	1.08 (-0.38, 2.53)
Talk about TV programs/videos	Crude	**-3.42 (-6.55, -0.30)**	-0.19 (-2.00, 1.61)	1.01 (-0.80, 2.83)
	Adjusted	-2.12 (-4.96, 0.72)	0.03 (-1.68, 1.73)	-0.13 (-1.89, 1.64)
Play counting/number games	Crude	1.11 (-2.33, 4.55)	-0.22 (-2.10, 1.67)	**2.16 (0.44, 3.88)**
	Adjusted	0.99 (-2.22, 4.20)	0.69 (-1.10, 2.47)	0.91 (-0.75, 2.56)
AS AVERAGE	Crude	**3.17 (2.01, 4.32)**		
	Adjusted	1.072 (-0.05, 2.20)*		

Abbreviations: CI = Confidence Interval
All regressions adjusted for child race, dual-language learner status, child health, and primary caregiver education
Values in bold are those that are significant at the 95% confidence level
*Approaches significance

Table 6. Adjusted and unadjusted mean difference estimates for the parent/caregiver involvement activities and DECA (social-emotional protective factors), as compared to a baseline level of 3-5 times

Activity		DECA (social-emotional protective factors)		
		None	**1-2 times**	**6-7 times**
		Mean Difference (95% CI)	**Mean Difference (95% CI)**	**Mean Difference (95% CI)**
Read	Crude	1.12 (-2.38, 4.62)	-1.06 (-2.15, 0.03)	0.23 (-0.98, 1.45)
	Adjusted	1.13 (-2.34, 4.60)	**-1.13 (-2.23, -0.03)**	0.16 (-1.06, 1.38)
Tell stories	Crude	-1.89 (-4.06, 0.28)	-0.82 (-1.91, 0.28)	0.37 (-0.87, 1.60)
	Adjusted	-1.98 (-4.15, 0.20)	-0.82 (-1.91, 0.28)	0.52 (-0.73, 1.76)
Teach letters/words/numbers	Crude	**-7.17 (-10.52, -3.82)**	-1.02 (-2.48, 0.44)	-0.52 (-1.52, 0.49)
	Adjusted	**-7.20 (-10.36, -4.04)**	-1.12 (-2.58, 0.33)	-0.31 (-1.33, 0.71)
Sing songs	Crude	**-2.66 (-5.29, -0.03)**	-0.81 (-2.15, 0.53)	-0.18 (-1.23, 0.86)
	Adjusted	**-2.74 (-5.39, -0.09)**	-0.94 (-2.28, 0.40)	-0.13 (-1.18, 0.92)
Describe child's experiences	Crude	0.10 (-2.53, 2.72)	0.62 (-0.63, 1.87)	0.69(-0.39, 1.76)
	Adjusted	-0.15 (-2.80, 2.50)	0.45 (-0.81, 1.70)	0.75 (-0.34, 1.83)
Teach song/music	Crude	**-3.02 (-4.86, -1.17)**	**-1.36 (-2.59, -0.13)**	-0.36 (-1.48, 0.75)
	Adjusted	**-2.97 (-4.83, -1.12)**	**-1.41 (-2.65, -0.18)**	-0.31 (-1.44, 0.81)
Arts/crafts	Crude	**-3.46 (-5.52, -1.40)**	-0.54 (-1.69, 0.60)	-0.22 (-1.40, 0.96)
	Adjusted	**-3.54 (-5.60, -1.48)**	-0.39 (-1.53, 0.75)	-0.16 (-1.35, 1.02)
Play indoor games	Crude	0.07 (-3.62, 3.76)	0.60 (-0.86, 2.07)	0.01 (-1.00, 1.03)
	Adjusted	0.34 (-3.34, 4.01)	0.68 (-0.78, 2.14)	0.17 (-0.85, 1.19)
Play sports	Crude	0.53 (-1.99, 3.05)	-0.452 (-1.69, 0.79)	0.33 (-0.76, 1.42)
	Adjusted	0.60 (-1.88, 3.78)	-0.37 (-1.61, 0.86)	0.42 (-0.68, 1.52)
Talk while doing everyday tasks/errands	Crude	-2.78 (-6.66, 1.10)	-1.32 (-2.91, 0.27)	0.01 (-0.98, 1.01)
	Adjusted	-2.67 (-6.52, 1.95)	-1.38 (-2.96, 0.21)	0.10 (-0.92, 1.10)
Talk about what happened at school	Crude	**-9.22 (-13.90, -4.53)**	-1.51 (-3.41, 0.38)	-0.40 (-1.37, 0.58)
	Adjusted	**-9.41 (-13.93, -4.89)**	-1.49 (-3.37, 0.38)	-0.38 (-1.36, 0.61)
Talk about TV programs/videos	Crude	-1.48 (-3.53, 0.56)	-0.23 (-1.41, 0.95)	-0.24 (-1.38, 0.89)
	Adjusted	-1.57 (-3.62, 0.49)	-0.30 (-1.48, 0.87)	0.00 (-1.15, 1.14)
Play counting/number games	Crude	-1.24 (-3.39, 0.91)	-0.42 (-1.62, 0.78)	-0.35 (-1.48, 0.78)
	Adjusted	-1.15 (-3.34, 1.04)	-0.38 (-1.60, 0.84)	-0.17 (-1.30, 0.97)
AS AVERAGE	Crude	0.42 (-0.36, 1.20)		
	Adjusted	0.57 (-0.23, 1.37)		

Abbreviations: CI = Confidence Interval
All regressions adjusted for child race
Values in bold are those that are significant at the 95% confidence level

Table 7a. Association between program dosage and parent/caregiver involvement

	Each additional year
Average Involvement	**0.03 (0.01, 0.05)**

Table 7b. Association between program dosage and parent/caregiver involvement, compared to a baseline of 2-3 years in the program

	Mean Difference (95% CI)				
	0-1 years	1-2 years	3-4 years	4-5 years	5-6 years
Average Involvement	**-0.11 (-0.17, -0.04)**	-0.05 (-0.11, 0.00)	0.005 (-0.08, 0.10)	0.02 (-0.08, 0.11)	0.15 (-0.05, 0.35)

Abbreviations: CI = Confidence Interval
Values in bold are those that are significant at the 95% confidence level

Appendix A

1. **In the past week**, have you or someone in your family done the following things with your child? If yes, tell us how many times you have done this in the past week.

	Circle an answer for each activity				
	No	**1-2 times**	**3 -5 times**	**6-7 times**	**Not Applicable**
a. Read your child a story?	a	b	c	d	e
b. Told your child a story?	a	b	c	d	e
c. Sang songs to your child?	a	b	c	d	e
d. Described/narrated what the child was experiencing?	a	b	c	d	e
e. Taught him/her songs or music?	a	b	c	d	e
f. Played with toys or games indoors?	a	b	c	d	e
g. Talked with him/her while doing everyday tasks and errands like going to the post office, the bank or the store?	a	b	c	d	e
h. Talked about what happened at Educare?	a	b	c	d	e
i. Talked about TV programs or videos?	a	b	c	d	e
j. Played counting games like singing songs with numbers or reading books with numbers?	a	b	c	d	e