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Caregiver Implementation of a Home-Based Reading Program With Their Children With Disabilities: Patterns of Adherence

Jessica A. R. Logan, PhD[1], Jaclyn M. Dynia, PhD[1], Laura M. Justice, PhD[1], and Brook Sawyer, PhD[2]

Abstract

The overall purpose of this study was to examine caregivers' adherence to a storybook-reading intervention using latent class analysis (LCA). This study also examined whether adherence was related to child and family characteristics including children's language ability, caregiver education, and whether the child has a disability. Caregivers of children with language impairment (N = 695) were provided with a book per week and were encouraged to read the book twice a week. Results of the LCA indicated that there were four profiles of caregivers' adherence: sporadic, late dropout, completers, and early dropout. Completers were so-named because they adhered to study activities for the duration, completed the study as designed. These caregivers represented one third of participants, whereas dropouts (both early and late) represented the majority of caregivers (51%). This study found no reliable differences in the adherence patterns for caregivers of children with a disability and their typically developing peers. However, children who had better language skills also had significantly higher probability of continued caregiver adherence. Implications for educational research are discussed.

Keywords

caregivers, language impairments, reading, home-based program

Young children with disabilities, especially those with language impairment, often show attenuated emergent literacy skills compared with children who are typically developing (Cabell, Justice, Zucker, & McGinty, 2009; Skibbe, Grimm, et al., 2008). Children's emergent literacy skills, such as print knowledge and phonological awareness, are robust predictors of later reading ability (e.g., National Institute for Literacy, 2006; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004; Sénéchal, LeFevre, Thomas, & Daley, 1998; Storch & Whitehurst, 2002). As such, there is strong interest in identifying effective practices for enhancing the emergent literacy skills of young children with disabilities (Gillon, 2002; Justice, Chow, Capellini, Flanigan, & Colton, 2003). Frequent high-quality caregiver–child book-reading interaction is a well-documented practice to improve the emergent literacy skills of children with disabilities (Dale, Crain-Thoreson, Notari-Syverson, & Cole, 1996; Lonigan & Shanahan, 2009).

Through ongoing participation in caregiver–child book-reading interactions, children develop vocabulary knowledge (Sénéchal, Thomas, & Monker, 1995; Whitehurst et al., 1988), phonemic awareness (e.g., Fielding-Barnsley & Purdie, 2003), and print knowledge (e.g., Justice & Ezell, 2002; Snow & Ninio, 1986) as well as interest in reading (e.g., Scarborough & Dobrich, 1994). Furthermore, intervention research studies using the caregiver–child storybook-reading context, such as those focused on dialogic reading and print-referencing, have found causal improvements in children's preliteracy skills in both the short and long term (Fielding-Barnsley & Purdie, 2003; Lonigan, Anthony, Bloomfield, Dyer, & Samwel, 1999; Piasta, Justice, McGinty, & Kaderavek, 2012; Whitehurst et al., 1999).

Providing caregivers with tools to improve their children's emergent literacy skills is of utmost importance when their children exhibit disabilities, especially when language skills are affected, for two reasons. First, children with language impairment are at heightened risk for reading difficulties (Catts, Fey, Tomblin, & Zhang, 2002), with some estimates indicating that they are 4 times as likely to have reading difficulties as their typically developing peers.

[1]The Ohio State University, Columbus, OH, USA
[2]Lehigh University, Bethlehem, PA, USA

Corresponding Author:
Jessica A. R. Logan, Schoenbaum Family Center, The Ohio State University, 175 E. 7th Ave., Columbus, OH 43201, USA.
Email: Logan.251@osu.edu

In addition, these reading difficulties tend to persist through the elementary grades and result in a functional disadvantage in literacy for these youngsters (Morgan, Farkas, & Wu, 2011; Skibbe, Grimm, et al., 2008). Second, several researchers have documented that caregivers of children with language impairments engage in fewer literacy activities than adults of children who are typically developing (Boudreau, 2005; Justice, Skibbe, McGinty, Piasta, & Petrill, 2011; Marvin & Wright, 1997; Skibbe, Justice, Zucker, & McGinty, 2008). Thus, it is especially important that the caregivers of children with language impairment be provided empirically validated ways to enhance their children's literacy skills during the early years.

The present article reports findings derived from a randomized controlled trial (RCT) of a print-referencing book-reading intervention that aimed to increase the frequency of caregiver–child storybook reading for children with language impairment enrolled in early childhood special education (ECSE) classrooms. Previous studies have identified significantly positive main effects of the teacher-delivered print-referencing intervention for children with language impairment and their typically developing peers within the participating ECSE classrooms (Justice, Logan, & Kaderavek, 2017; Justice, Logan, Kaderavek, & Dynia, 2015). The purpose of the current work is to explore adherence among caregivers of children with language impairment when implementing this shared reading intervention in their home over an academic year. Understanding the extent to which caregivers can implement home-based interventions as intended helps scientists and practitioners understand the extent to which supports must be provided to caregivers to enhance their implementation.

Intervention adherence is one of five aspects of implementation fidelity (Dane & Schneider, 1998), and it refers to the extent to which the persons providing the intervention are observed to implement the program as it was intended. If a research-based intervention is not carried out as designed, it has implications for conclusions drawn about the expected impacts of the intervention on participant behaviors and skills. In addition, adherence has vital implications for drawing conclusions about the real-world applications of a given intervention. Low levels of adherence can indicate that the intervention as designed may not be feasible for participants to implement (Lee, Penfield, & Maerten-Rivera, 2009). Yet, few educational researchers have explicitly conducted research on participants' fidelity to intervention implementation as a means for advancing understanding of effective interventions (Dane & Schneider, 1998; Hulleman & Cordray, 2009), and this is particularly true for caregivers of children with disabilities.

Evidence suggests that some caregivers of children with language impairment will not be able to implement intensive interventions in their home or sustain them over long periods of time (see Justice, Logan, & Damschroder, 2015). To this end, it is also important to understand the characteristics of families who do not fully complete intervention requirements to devise appropriate methods to bolster participation. For example, literacy intervention studies that involve families of higher socioeconomic status (SES; that is, higher income and education) typically report high parent participation (Arnold, Lonigan, Whitehurst, & Epstein, 1994; Jordan, Snow, & Porche, 2000; Justice, Kaderavek, Bowles, & Grimm, 2005), whereas studies with low-SES or mixed-SES participants report a wider range degree of implementation (Arnold et al., 1994; Baker, Piotrkowski, & Brooks-Gunn, 1999; Lonigan & Whitehurst, 1998). Such findings may suggest that lower SES parents may require extensive supports in implementing a home-based intervention over time relative to their more economically advantaged counterparts. However, work by Roggman, Boyce, and Innocenti (2008) found that mothers of children with disabilities were less likely to drop out of an Early Head Start home visiting program, which the authors suggested was due to caregivers of children with disabilities attributing greater importance to the home visiting services. This evidence suggests that there may be individual differences in patterns of adherence, and such patterns may be dependent on whether children have a disability.

Study Purpose

The overall purpose of this study was to examine caregivers' adherence to a storybook-reading intervention conducted in their homes over an academic year during which their children were enrolled in an ECSE classroom. Two specific questions guided our work. First, we sought to describe and investigate patterns of caregiver adherence, by exploring whether there were profiles of adherence that reliably represented caregiver implementation of the home-reading program. Most previous work that has investigated participant fidelity and retention have relied on variable-centered (e.g., means and correlation-based) approaches (Green, Polen, Dickinson, Lynch, & Bennett, 2002; Senturia et al., 1998). In the present study, we expand on this literature to use a person-centered or profile-based approach. We were interested in examining patterns rather than average performance across all participants because averages may mask potentially important information about participants' behavior. Where averages collapse across multiple indicators, profiles capture not only each person's performance on each indicator but also the way the indicators covary. Such patterns of performance can indicate or distinguish between qualitatively different groups of responders.

Second, we sought to examine whether adherence was related to child and family characteristics, including the child's language ability, caregiver education, and whether the child had a disability. Concerning this latter aim, it is reasonable that caregivers of children with lower language

ability may perceive a greater need for participating in a storybook intervention. We have previously discussed that children who have a language impairment are more likely to exhibit reading difficulties (Bishop & Adams, 1990; Catts et al., 2002). Combining this with the research suggesting that caregivers are more likely to complete an intervention when they believe it meets their needs (e.g., Coatsworth, Duncan, Pantin, & Szapocznik, 2006), we believe caregivers of children with disabilities may then be more likely than caregivers of children who are typically developing to adhere to the provided literacy-focused intervention.

Method

Participants

The participants in this study were involved in a multicohort RCT in which children's teachers and caregivers engaged in a 30-week book-reading intervention. In the RCT, teachers were ascertained into the study first; caregivers of children in their classrooms were then invited to participate. The ECSE programs from which teachers and caregivers were recruited were located in two large cities in a Midwestern state. The majority of caregivers elected to participate (~80% average enrollment across classrooms). Classrooms were ECSE settings, designed to serve an approximately equal mix of children with and without disabilities with a target enrollment of 6:6. The caregivers enrolled in this study included those with typically developing children and children with disabilities.

In the present study, we focused on the caregivers of the children and their adherence over the 30-week period to the home book-reading intervention. Caregiver/child dyads were not included in the present study if they moved (n = 42); their children's classroom teacher withdrew from the study, at which point the children in the classroom were lost to the study (n = 10), or they explicitly withdrew their child from the study (n = 10). The final sample consisted of 695 caregivers of preschool children attending ECSE programs. Descriptive information about the included dyads is presented in Table 1. Caregivers completed a self-reported survey at the time of enrollment, at which point information about the demographic characteristics of their family was obtained. Of these participants, 87% were mothers, 10% were fathers, 2% were grandparents, and 1% were guardians/other. Ten caregivers (2%) reported that their child spoke a language other than English in the home. In terms of highest level of maternal education, used as a metric of SES, 8% of caregivers did not graduate from high school, 33% had obtained a high-school diploma, 19% had obtained a Bachelor's degree, 18% had obtained an advanced degree, and information was missing for the remaining 22% of caregivers. As highest level of education was examined in subsequent analyses, multiple imputation was used to retain the 22% of caregivers with missing data. Results are collapsed across 10 imputations.

Table 1. Sample Descriptive Information.

Characteristic	*M*
N	695
Child's age in months	
M	51.64
SD	8.09
Child is female	
%	35
SD	0.48
Child's disability status	
%	56
SD	0.50
Maternal education	
High school diploma or less	30%
College degree	42%
Advanced degree	28%
Child's fall language	
M	76.02
SD	17.58

The children of these caregivers were predominantly male (64%, n = 361) and Caucasian (65%, n = 449), and they were approximately 4 years, 4 months old (SD = 8 months) in the fall of the year. Slightly more than one half of the children had an identified disability (56%, n = 387) based on their eligibility for special-education services and presence of an Individual Education Plan (IEP). Provision of special-education services in ECSE programs is noncategorical, although, according to parent report, about 25 of the children had an identified disability, such as hearing loss, autism spectrum disorder, and Down syndrome.

Overall Study Design

The current study is part of a larger multicohort RCT to determine the efficacy of a print-referencing style on the emergent literacy skills of children with disabilities. Print-referencing is a style of reading to increase children's print knowledge whereby adults draw children's attention to print through highlighting the forms and functions of print (see Justice & Ezell, 2004, for a more description). The overall study design involved both ECSE teachers and caregivers of children enrolled in the teachers' classrooms, with teachers reading in the classroom and caregivers reading at home. However, because we focus only on caregivers in this study, we provide only caregiver procedures.

In the RCT, some caregivers were asked to read with their children using a print-referencing style, whereas others read using their normal style. All caregivers regardless of condition were asked to read twice per week for 30 weeks for a

Table 2. Means, Standard Deviations, and Cohen's *d* Effect Sizes of Outcome Measures by Caregivers' Randomly Assigned Condition.

	Total		Regular reading condition (control)		Print referencing condition (treatment)		Control – Treatment
Outcome	*M*	*SD*	*M*	*SD*	*M*	*SD*	Cohen's *d*
Mid-year phone call	0.91	0.29	0.89	0.32	0.96	0.19	−0.26
End-of-year phone call	0.75	0.43	0.74	0.44	0.78	0.42	−0.08
Postcards	13.62	10.65	14.1	10.43	12.62	11.04	0.14

Note. Cohen's *d* has traditionally used 0.20–0.49 as the range for a "small" effect (Cohen, 1992).

total of 60 reading sessions. All caregivers were provided with books and a predetermined reading schedule. Each week, the caregiver received one new storybook and was asked to read it with their child 2 times each week. Caregivers were allowed to keep the 30 storybooks as incentive to participate in the program, and no other incentives were provided. Research staff discussed with caregivers in both conditions the study procedures, including the importance of providing researchers with information about reading implementation through the phone calls and postcards, which are described below as measures of adherence.

In addition, caregivers in the print-referencing condition were provided an initial and individual 2-hr training in their home or a neutral location of their choosing to teach them how to implement the print-referencing style and about study procedures, and were given soft scripts per book to suggest ways they can highlight different forms and functions of print. Parents in the regular reading condition did not receive this orientation or the scripts. Because initial meetings and the implementation requirements of the study differed between the two conditions, we also tested the extent to which the measures of adherence (listed below) differed between conditions. Results of this analysis are presented in Table 2, which includes means, standard deviations, and effect sizes of the differences between these two groups. We found small differences that did not consistently favor either condition. Note that we also ran analyses including the randomized condition in the model, and its inclusion did not change any of the reported results in the subsequent sections.

Measures of adherence. We collected data on caregiver adherence through two sources: successful contact with caregivers on two representative phone calls and percentage of postcard logs that were returned. These measures shed light on caregivers' level of commitment to participating in the book-reading intervention. These two methods were of interest due to the differing nature of caregivers' responsibility. Whereas answering a phone call required less effort by caregivers, sending postcard logs necessitated more initiative by caregivers.

Phone calls. Throughout the study, caregivers were contacted regularly via phone calls conducted by core project staff. Caregivers were contacted monthly or bimonthly on a predetermined schedule. Each phone call lasted approximately 5 min. During each phone call, the caregivers were asked whether they were reading according to schedule, whether their children enjoyed the books, and whether they needed any support or had any questions about the book-reading intervention. They were also reminded of the importance of reading with their children. If the caregiver could not be reached, the researcher would leave up to five messages before abandoning that specific scheduled call. A successful phone contact for a given scheduled call was registered if the caregiver answered or returned the phone call such that direct contact between the caregiver and project staff was made. This study focuses on whether a successful phone contact was accomplished mid-year and at the end of the year. Two phone calls were selected as representative caregiver phone calls, as the first phone call showed almost no variance with only 7% of families missing this call.

Postcard logs. All caregivers were requested to submit postcards to project personnel on a weekly basis to log their participation in the 30-week home-based intervention. Each caregiver was provided a packet of preaddressed and stamped postcards with preprinted information to which caregivers would respond. Participants were asked to fill out and return one postcard for each week of the intervention, for a total of 30 weeks (and thus 30 postcards). The postcard packet was placed on a refrigerator magnet for ease of use, with a reminder on the magnet for caregivers to complete the postcard each week and submit to the project staff. Each postcard provided the title of the book to be read that week.

Supplementary measures. To address our second research aim, data were also collected on maternal education, whether the child had a disability, and children's language skills. Maternal education was collected through a demographic survey that caregivers completed at the time of enrollment. Caregivers reported the mother's highest level of education as one of 11 options, which ranged from less than a high school to a doctoral degree. Child disability status (dichotomous variable) was reported by the classroom teacher. Children's language skills were indirectly assessed using the Descriptive Pragmatics Profile (DPP) of the *Clinical Evaluation of Language Fundamentals Preschool–2*

(CELF-P2; Wiig, Secord, & Semel, 2004). The DPP is a measure of children's nonverbal communication and conversational language skills that is completed by the child's teacher. Items include a series of 26 statements. Teachers respond to the statements (e.g., the child points to request a desired object, shakes head for "no" [or expresses other nonverbal messages]; the child appropriately introduces new conversation topics) using a Likert-type scale of 1 (*never*) to 4 (*always*). Based on the manual, the DPP has high internal consistency and test–retest reliability (.95 and .87, respectively; Wiig et al., 2004). Based on the current sample, Cronbach's alpha was .97, which indicates high reliability. Raw total scores were used in the final analyses.

Analysis

Aim 1: Description and patterns of adherence. Adherence for each caregiver was examined based on successful phone call contacts and the caregiver's percentage of successful postcards returned over 30 weeks. We hypothesized that individual differences might emerge in the nature of caregivers' contact with project staff over the duration of the intervention. For example, if two caregivers both returned 50% of the requested postcards, one might return the first 15 postcards and then stop part-way through the intervention, whereas the other might return postcards sporadically across the 30-week duration of the study. The extent to which these might exist within the data was examined using latent class analysis (LCA), which is an empirically driven method used to classify individuals into groups. In LCA, the user provides a number of groups to be estimated and then the LCA places each participant in the group based on that participant's responses. For example, if the LCA was asked to find two groups of responders, it is likely that one group would represent participants who logged few readings on their postcards, whereas the second group would represent those who logged most of the readings.

In the present study, the number of groups of caregivers cannot be anticipated based on the extant literature. When such is the case, an exploratory analysis can be conducted to determine the optimal number of groups for the data (B. O. Muthén, 2006; Nylund, Asparouhov, & Muthén, 2007). This approach was used in the present study using Mplus statistical software (L. K. Muthén & Muthén, 2007) using the Mplus LCA helper (Uanhoro & Logan, 2017). The exploratory approach requires that several models be fit to the data, each with an increasing number of groups. In the current study, we fit four models to the data (one each representing two, three, four, and five groups). Model comparisons were then used following methods identified in Nylund et al. (2007), and allowed us to determine which of the models, and thus which number of groups, best represents the data. Three indices were used to identify the best-fit model: the Bayesian information criterion (BIC), the Akaike information criterion (AIC), and the bootstrap likelihood ratio test (BLRT). The AIC and BIC are goodness-of-fit indices where lower values indicate better model fit. The BLRT is a statistical test of whether the given number of groups fits significantly better than a model with one fewer group. The model with the lowest BIC/AIC value, where the BLRT test was found to be significant was considered the best-fitting model. Following that identification, the best-fitting model was examined in terms of how unique each of the profile identifications was using the entropy statistic. A high entropy value (greater than 0.8) was required for the model to be considered to have good fit to the data.

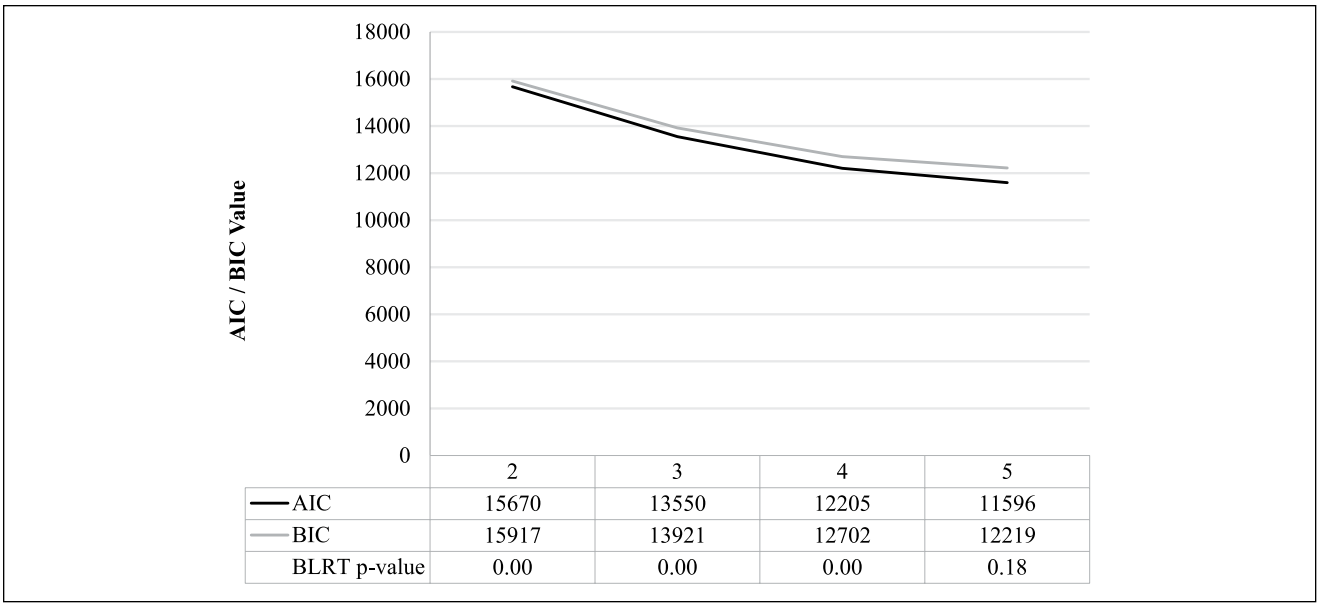
Aim 2: Prediction. For the second aim of the study, adherence was predicted by child and family characteristics. Four different outcomes were examined: (a) whether phone contact was successful at the middle of the year, (b) whether phone contact was successful at the end of the year, (c) the probability of returning the postcards, and (d) the postcard group assignment from the LCA conducted as part of Aim 1. As the first two outcomes (a and b) were dichotomous, these were investigated using a logistic regression. Assessing the probability of returning the postcards was also dichotomous, but there were 30 observations for each participant. To account for the nested structure of the data, probabilities were calculated using multilevel logistic regression (Hierarchical General Linear Model; HGLM), using SAS proc GLIMMIX. The HGLM models also included the weekly postcard number; which allowed us to assess whether probabilities generally increased or decreased across the duration of the study. The distribution of the fourth outcome (group membership from the LCA) was categorical and was addressed using multinomial regression analysis.

Results

Description and Profiles of Caregiver Adherence

Caregivers' adherence was assessed with three indicators: Phone call contact success in the middle of the year, phone call success at the end of the year, and the total number of returned postcards. For the phone calls, 80% of participants were successfully contacted in the middle of the year, whereas only 66% were successfully contacted at the end of the year. On average, 13 postcards (about 42%) were returned by each caregiver, with only 16 caregivers (2%) returning all 30 requested postcards. There were 187 caregivers (24% of the sample) who returned zero postcards.

LCA was used to determine whether different profiles of caregiver involvement and retention were observed based on the postcard return data. Five models were compared to determine best model fit (two to six classes of responders). The AIC and BIC for the five competing models are reported in Figure 1. In Figure 1, it is clear that the AIC and BIC



	2	3	4	5
AIC	15670	13550	12205	11596
BIC	15917	13921	12702	12219
BLRT p-value	0.00	0.00	0.00	0.18

Figure 1. Model fit results from latent class analysis.
Note. The model with four classes was retained as it was the model with the lowest AIC/BIC value, with the largest number of classes with a significant BLRT. AIC = Akaike information criterion; BIC = Bayesian information criterion; BLRT = bootstrap likelihood ratio test.

begin to cease their deceleration around the four-group model, leading us to conclude that the LCA identified four well-defined groups of caregivers with respect to their continued study involvement (Entropy = 0.98).

The frequency distributions of the *number of postcards returned* in each assigned group are pictured in Figure 2 (the *x*-axis represents the total number of postcards returned, and the *y*-axis represents the number of caregivers returning each postcard). From Figure 2, the caregivers assigned to Groups 1 and 2 both appear to have returned approximately half of the postcards, the caregivers in Group 3 returned most of the postcards, and those in Group 4 returned almost none of the postcards. When the order of postcards is accounted for, a clearer pattern emerges. In Figure 3, the *x*-axis represents the *timeline* of the intervention (in weeks), and the *y*-axis represents the percentage of the sample who returned the postcard for that given week.

As the data in Figure 3 make clear, there are patterns that reflect the caregivers in terms of their sustained involvement and retention in the study based on receipt of postcards. The caregivers in Groups 1 and 2 (those who returned approximately half of the postcards) do show some visually compelling differences. Group 1 caregivers had a low return rate in the middle, but had a high return rate at the start and at the end of the intervention, so we refer to this as the "sporadic" group ($n = 109$). Group 2 showed high return rates until about halfway through the intervention, so we refer to them as the "late dropout" group ($n = 53$). Group 3 demonstrated a high return rate for all postcards, and thus we refer to these caregivers as the "completers" ($n = 262$). Finally, Group 4 caregivers returned almost none of the postcards; we thus refer to these caregivers as the "early dropout" group ($n = 271$). Descriptive statistics for each profile are provided in Table 3.

Predicting Caregiver Adherence and Profiles

To address the second study aim, caregiver adherence was examined with respect to (a) probability of successful phone-call contact mid-year, (b) probability of successful phone-call contact at the end of the year, (c) probability of returning postcards, and (d) group membership of postcard responses per results of the LCA. Adherence was predicted from education level, child language ability, and whether the child had a disability.

The results for the first three outcomes were examined with logistic regression (postcards with hierarchical generalized logistic model), and the results are reported in Table 4. In Table 4, the intercept is interpreted as the log odds of success (compared with not succeeding). For example, caregivers were almost 3 times more likely to successfully complete the mid-year phone call than to not complete it (log odds = 2.91, $p = .002$). The odds ratio indicates that families are 18 times more likely to successfully complete the end-of-year phone call than to not complete it. In contrast, the remaining predictors are interpreted as the difference in the log odds for a one-unit change in that predictor. For the phone call outcomes, the only significant relation was that of disability status for the end-of-year phone call, where the coefficient −1.88 suggests that families with a child who has a disability are significantly less likely to make contact at the end of the

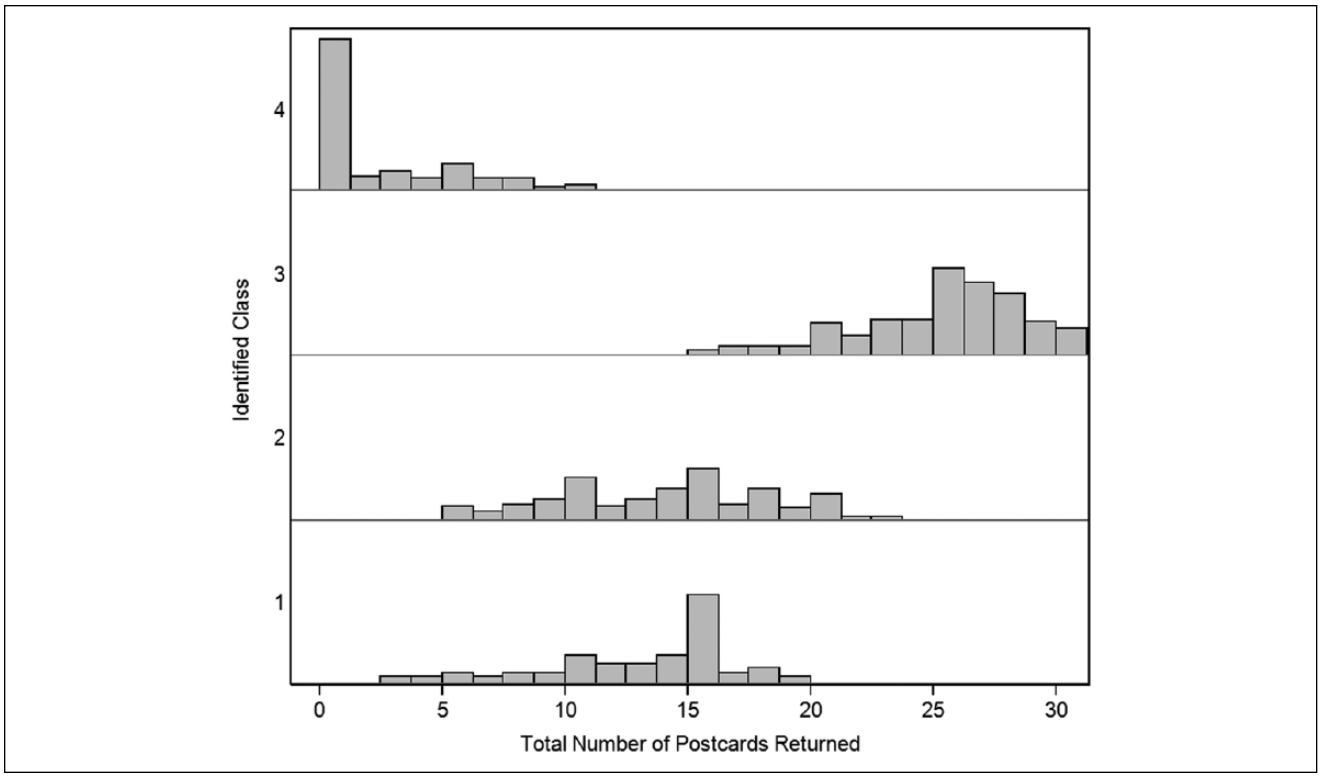


Figure 2. Percentage of the sample (*y*) who returned a given number of postcards (*x*) per identified class.

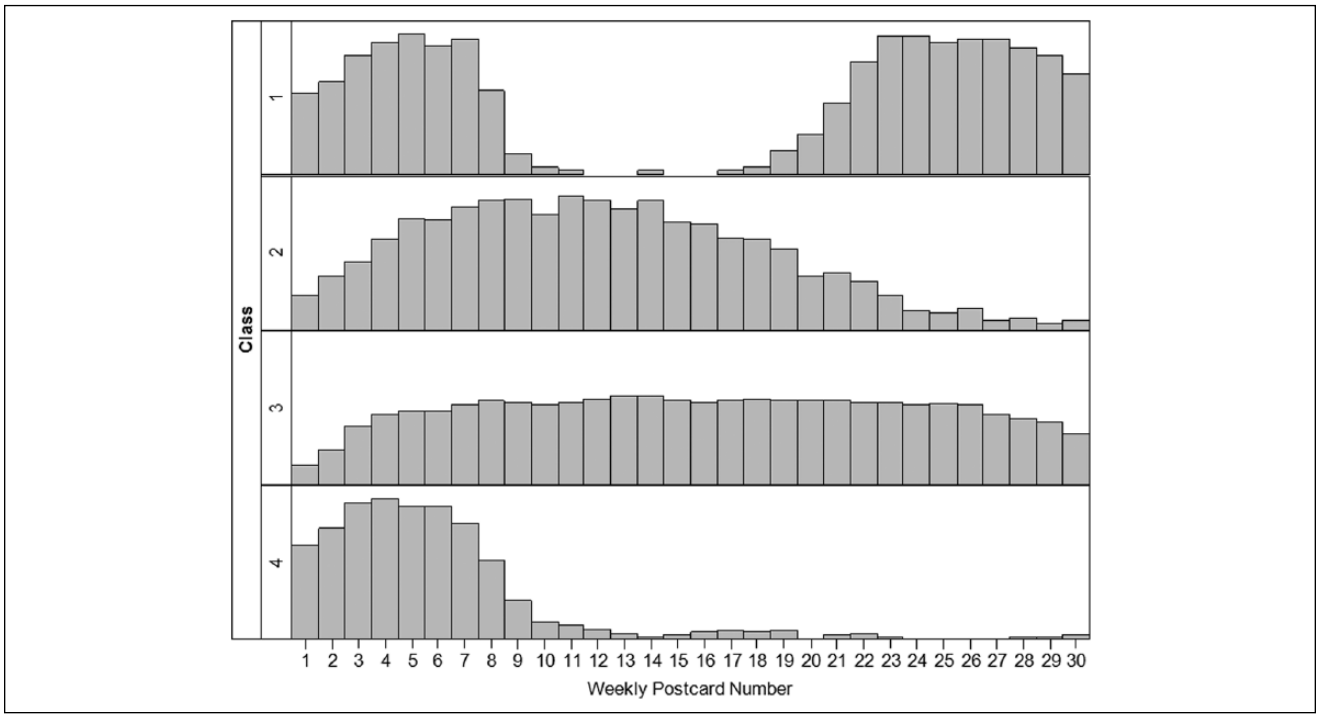


Figure 3. Average participant probability of return (*y*, range = 0–1) for each week's postcard (*x*).
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Table 3. Demographic Information for Each of the Four Groups Extracted From the LCA.

	Group profiles			
Class membership	1: Sporadic	2: Late dropout	3: Completer	4: Early dropout
Group, *n*	53	109	262	271
Female children	35% (0.48)	40% (0.49)	35% (0.48)	33% (0.48)
Children with a disability	56% (0.50)	50% (0.50)	53% (0.49)	59% (0.50)
Maternal education	5.86 (3.10)	5.84 (2.43)	6.63 (2.29)	5.46 (2.62)
Child language	70.51 (16.16)	78.99 (16.23)	80.33 (16.12)	71.73 (18.10)
No. of postcards returned	13.25	13.83	25.37	2.25

Note. Groups correspond to those represented in Figure 3. Values in parentheses are standard deviations. Numbers in the female and IEP columns represent the percentage of children within group who are female and who have an IEP, respectively. Maternal education had a range of scores from 1 to 11, where 5 = some college, 6 = associates or 2-year degree, and 7 = bachelor's degree. Child language skills are raw scores. LCA = latent class analysis; IEP = Individual Education Plan.

Table 4. Logistic Regression Results of Study Design Components for Continued Study Involvement.

	Mid-year phone call			End-of-year phone call			Post cards[a]		
Parameter	Log odds	Odds ratio	*p*	Log odds	Odds ratio	*p*	Log odds	Odds ratio	*p*
Intercept	2.91	18.38	.002	2.00	7.42	.001	−0.54	0.58	.121
Disability	−0.03	0.97	.933	−1.88	0.15	<.001	−0.11	0.89	.497
Maternal education	−0.05	0.95	.416	0.07	1.07	.093	0.09	1.09	.005
Child language	−0.01	0.99	.659	0.01	1.01	.480	0.02	1.02	.001
Postcard number	NA			NA			−0.03	0.97	<.001

Note. The estimate for the intercept was centered to represent the probability of returning the fifth postcard, with postcard number indicating the reduction in the log odds of returning each subsequent postcard. HGLM = Hierarchical General Linear Model.
[a]Post cards were analyzed in HGLM with observations nested within family.

year. The odds ratio of 0.15 suggests that caregivers who have a student with a disability are 6 times less likely to complete an end-of-year phone call.

For the postcards results, the nonsignificant coefficient for the intercept suggests that at the fifth postcard (where the analysis was centered), caregivers were equally likely to return or not return a postcard. Mother's education was significantly positively related to the probability a given postcard would be logged, and children with increased language skills were more likely to have logged postcards. The negative log odds for postcard number (log odds = −0.03, $p < .01$) indicates that later postcards have a significantly lower probability of being completed.

To determine whether extracted group membership was related to family and child characteristics, a nominal regression was conducted. Results are reported in Table 5. For this analysis, the fourth group (early dropout) was selected as the referent, as it was the largest group of caregivers identified in the LCA. Results suggest that none of the predictors we included were significantly useful in distinguishing between families classified in the sporadic (Group 1) and early dropout (Group 4). For the final contrast, between the completer group and the early dropout group, we found that both maternal education and child language were positively associated with a profile of caregivers who remained engaged in the study, such that higher maternal education and higher child language skills were positively associated with retention. In none of the comparisons was disability status a defining characteristic of the identified profile.

Discussion

This study had two major aims: First to examine caregiver adherence to a 30-week book-reading intervention, and second to predict adherence from parent education, children's language skills, and whether the child had a disability. This study is unique in that it sought to determine whether there were profiles that could reliably represent caregivers' ongoing intervention implementation. Although prior studies have suggested that at least some caregivers who are asked to read regularly with their children at home exhibit difficulties maintaining these practices over time (Justice et al., 2011; Lonigan & Whitehurst, 1998), few studies have sought to determine whether there are patterns that may serve to profile caregivers in their maintenance of these practices. Unlike average effects, the examination of profiles, or groups, of participant response can illuminate and identify potential heterogeneity in responses. The present results found four unique profiles of

Table 5. Nominal Multiple Regression Predicting Class Membership From Disability Status, Maternal Education, and Child Language Skills.

Parameter	*B*	*SE*	Wald	Significance	Odds ratio
1 (sporadic) vs. 4 (early)					
Intercept	−0.78	0.82	0.89	.347	
Maternal education	0.06	0.06	0.89	.347	1.06
Child language	−0.01	0.01	0.88	.350	0.99
Disability	−0.32	0.35	0.83	.364	0.73
2 (late) vs. 4 (early)					
Intercept	−2.54	0.68	14.01	.000	
Maternal education	0.02	0.05	0.21	.651	1.02
Child language	0.02	0.01	8.49	.004	1.02
Disability	−0.09	0.27	0.11	.737	0.91
3 (completers) vs. 4 (early)					
Intercept	−2.59	0.55	22.50	.000	
Maternal education	0.17	0.04	17.89	.000	1.19
Child language	0.03	0.01	23.86	.000	1.03
Disability	0.21	0.21	1.02	.313	1.24

Note. Groups correspond to those identified in the LCA and presented in Figure 3. The reference category is the early dropout group (4). LCA = latent class analysis.

caregivers' study involvement over 30 weeks: sporadic, late dropout, completers, and early dropout.

An important contribution of this study is that it suggests the value of examining profiles of study participants' adherence to program activities. Many studies of participant retention rely on variable-centered approaches (Green et al., 2002; Senturia et al., 1998), whereas person-centered approaches such as LCA can be illuminating. Without the profile-based approach, results would only demonstrate that caregivers returned, on average, 13 of the 30 postcards. Instead, the more informative person-centered approach gives some insight into the different types of behaviors caregivers had in response to study requests. For example, the caregivers in the completer group are the only group of caregivers who implemented the intervention as intended by regularly submitting logs across the duration of the study. This means that only 37% of caregivers were able to, or chose to, implement the intervention as designed. The 39% of the sample who elected to drop out of study participation very early on are an equally important population to examine when considering the development of later interventions. Through examining profiles of participation, researchers can also identify potential targets for intervention supports. For example, we identified that caregivers of children with disabilities were less likely to complete the study (less likely to be in the "completer" group). Future studies can test whether preemptively adding behavior change supports will help these caregivers to complete study activities.

In regard to the second aim of predicting adherence from child and family characteristics, we hypothesized that caregivers of children with disabilities or lower language skills would be more likely to adhere to the book-reading intervention because they may perceive a greater need for participating than caregivers of children who are typically developing or have stronger language skills. This was not the case for two of the three of the examined outcomes; we found no differences between the adherence patterns during the mid-year phone call and the postcard logs. However, for the postcard logs and for the end-of-year phone call, we did find that maternal education and children's language skill significantly contributed to the probability of returning postcards, such that mothers who were more highly educated and had children with better language skills were more likely to return postcards. Several potential constructs may underlie this observed relation. For example, it is possible that children with better language skills may have had enjoyed the book reading sessions more than those with poorer language, leading to caregivers being more likely to return the postcards. It is also possible that parents of those children with higher language skills were more actively involved in or more aware of their children's development, and were therefore also more likely to return the postcards. Each of these potential explanations is a candidate for exploration in future studies.

One finding of note is how caregivers' involvement varied as a function of time. Although it is well understood that longitudinal work presents special risks to the retention of participants over time, in that the participants need to make a longer term commitment than engaging in a project for a single point in time (Sullivan, Rumptz, Campbell, Eby, & Davidson, 1996), there has been little attention as to when participants are lost over time. We explored this issue in the present study by using hierarchical nonlinear growth model, in which 30 dichotomous observations (postcard returns)

were nested within each participant, with postcard order entered as a predictor. If we accept that postcard returns represent ongoing retention in a longitudinal study, the results of these analyses help us understand when participants are lost over time. In general, it was found that participation decreased slightly, but significantly, over time. This suggests that participants are not lost at a singular point of time, but rather very gradually as the study progressed.

Study Limitations

Several limitations are important to point out. First, it is important to point out that this project involved laypersons as interventionists, and the results may differ if the participants were professionals (e.g., nurses, therapists, teachers). For instance, in our own work, we have found that teachers maintain high levels of study participation over long-term periods of study involvement (Piasta et al., 2010). Thus, the results may not generalize from caregivers to other types of interventionists.

Second, in this study, we used a proxy measure of phone calls and postcard logs as a measure of adherence to the ongoing implementation of the intervention by caregivers. However, the validity of this assumption is not ensured. In general, we believe the postcard return rate is the most stringent test of ongoing study involvement because contact was not initiated by project staff. Rather, participants had to remember, on their own accord, to return postcards to the project, thus stipulating their own ongoing interest in the study. Therefore, we believe that the findings from the postcards may be most generalizable to other studies in this area.

Although we recognize that postcard submission patterns may not necessarily represent patterns in caregivers' implementation of reading sessions, we do speculate that it is plausible to consider that postcard submission patterns may represent patterns of implementation of the intervention. With few exceptions, caregivers noted that they had successfully completed the readings on each returned postcard. It may be that caregivers are indicating they are reading with their children on the postcards but not implementing the intervention. Likewise, it may be that caregivers are implementing the intervention but are not returning postcards. The incorporation of other types of data, such as observations, focus groups, or interviews, would provide a means by which to investigate the degree to which our assumption that answering phone calls and returning postcards are actually associated with intervention implementation as well as contribute to a fuller understanding of why participants may have difficulty sustaining communication with researchers. In addition, there is a significant need to develop avenues for closely monitoring intervention implementations when they are done at a distance from the research site, which is the case in most interventions that have passed the efficacy phase.

Implications for Practice

Findings from the current study suggest directions for intervention developers and researchers, especially those seeking a longer term commitment from participants. First, as noted above, participants were likely to show a gradual decline in involvement over time. Thus, the conventional method of periodic phone calls to provide study reminders does not seem to be sufficient to stem attrition. With the rise of social media, such platforms as Facebook and similar technologies may provide an important mechanism for maintaining steady contact with participants (Mychasiuk & Benzies, 2012). Also recently, researchers have experienced success in using text messages to increase participation in interventions (see Kong, Ells, Camenga, & Krishnan-Sarin, 2014, for a review in smoking cessation). Use of current technology may be particularly important when complex interventions are being utilized.

Second, caregiver and child characteristics were related to study adherence. Caregivers who were more highly educated and had children with better language skills were more likely to return postcards, while caregivers of children with disabilities were less likely to have a successful end-of-year phone call. Thus, simplistically, it appears that caregivers with more education may require less training regarding the need to communicate regularly with researchers than caregivers with less education. Providing more information to families, and potentially more varied ways to communicate (as described above), may be an effective means to increase participant adherence. Furthermore, results suggest that caregivers of children who have diminished skills may need additional supports to sustain participation in interventions. For instance, if we conjecture that lower postcard return is related to caregivers' difficulty with reading to children with disabilities/lower language skills, then caregivers may benefit from suggestions on how to modify reading sessions to the needs of their children while reading.

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