

A Combined Reach Out and Read and Imagination Library Program on Kindergarten Readiness

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OBJECTIVES: Sharing books with preschoolers is known to improve kindergarten readiness. Both Reach Out and Read (ROR) and Dolly Parton's Imagination Library (DPIL) have shown positive effects on book sharing at home. We developed a novel combined ROR/DPIL program and examined the effect on kindergarten readiness assessment (KRA) scores.

METHODS: At urban ROR primary care sites, patients <5 years living in the city school district were enrolled from July 2015 through January 2019 in the ROR/DPIL program when seen for a clinic visit. The literacy subtest of the KRA was examined for participants entering kindergarten in the fall of 2016, 2017, and 2018. The "on-track" rate of participants was compared with nonparticipant groups.

RESULTS: A total of 797 kindergarten-aged ROR/DPIL participants were matched to Ohio KRA scores for 2016, 2017, and 2018 school years. The percentages of students "on-track" on KRA literacy subtests increased significantly by cohort (2016, 42.9% [95% confidence interval (CI): 34.9%–50.9%] versus 2017, 50.9% [95% CI: 44.9%–56.9%] versus 2018, 58.3% [95% CI: 53.3%–63.3%], $P = .004$). ROR/DPIL participants were compared with a proportionate stratified random sample of 1580 non-ROR/DPIL peers. On-track in literacy did not significantly differ between groups (2016 [$P = .262$], 2017 [$P = .653$], 2018 [$P = .656$]), nor did they differ after restricting analysis to economically disadvantaged children (2016 [$P = .191$], 2017 [$P = .721$], 2018 [$P = .191$]).

CONCLUSIONS: With these results, we suggest that a program combining literacy anticipatory guidance at clinic visits and more books in the home can potentially improve kindergarten readiness. Pediatric health care providers can play an important role in promoting kindergarten readiness through literacy promotion.

abstract

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Dr Mitchell, Mr Petronio, and Ms Johnson conceptualized and designed the study, collected data, and performed statistical analysis; Drs DeWitt, Szumlas and Ms Henry conceptualized and designed the study; and all authors aided in data interpretation, and worked on drafting, reviewing, and revising the manuscript, approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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WHAT'S KNOWN ON THIS SUBJECT: Sharing books with preschoolers promotes speech and language development, preliteracy skills, and, ultimately, kindergarten readiness. Both Reach Out and Read and Dolly Parton's Imagination Library have shown positive influences on the home literacy environment of preschoolers.

WHAT THIS STUDY ADDS: In this early study, we suggest that when combined and sustained, these two programs have the potential for effectively reaching large populations of at-risk children and improving kindergarten readiness.

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Arriving at kindergarten ready to learn is vitally important. Not only has it been shown that children who start behind often stay behind, but adequate kindergarten readiness is also strongly correlated with later achievement.¹⁻³ Unfortunately, only 50% to 75% of children in the United States enter kindergarten ready to learn, with children from economically disadvantaged households at particular risk for poor kindergarten readiness.⁴⁻⁶

Sharing books with preschoolers promotes speech and language development, preliteracy skills, and ultimately kindergarten readiness. The American Academy of Pediatrics recommends that pediatricians promote reading from birth, and it has even been suggested that literacy be treated as a distinct developmental domain.^{7,8} Researchers in multiple studies have demonstrated that reading aloud with young children promotes the foundational skills necessary for later reading success.⁹ In recent functional studies, researchers have shown that sharing books with young children activates and reinforces the pathways associated with literacy skills, further supporting the importance of book sharing.¹⁰⁻¹² Children who are exposed to a strong literacy environment have better academic outcomes.^{13,14} In short, children who are read to frequently and have ready access to print materials do better in school. Unfortunately, children living in poverty often have limited access to books and experience less shared reading and exposure to language.^{15,16}

Reach Out and Read (ROR) and Dolly Parton's Imagination Library (DPIL) are two programs developed to promote book sharing in preschoolers. ROR emphasizes caregiver education whereas DPIL concentrates on providing books. ROR is a primary care-based nationwide program that makes guidance on reading a standard part of well-

child visits for children from birth to age 5. At ROR clinics, pediatric providers discuss the importance of reading, model age-appropriate reading techniques, and provide a book for the child to take home.¹⁷ Through regularly scheduled well-child visits, ROR practitioners have unique, repeated encounters with families during this critical period of brain development. Additionally, ROR tends to operate in clinics reaching underserved populations.¹⁸ Families who participate in ROR are more likely to read and share books with their children, enjoy reading together, and feel that sharing books is an important activity.¹⁹⁻²³ Older toddlers and preschoolers exposed to ROR exhibit higher expressive language, receptive language, and vocabulary scores than peers not exposed to the program. This effect is attributed to the increased time ROR families spend sharing books with their children.¹⁹⁻²²

DPIL promotes literacy by delivering books to the homes of preschoolers. In the United States, there are >1500 active affiliates reaching parts of all 50 states, with >1.5 million enrollees. Once enrolled, children from birth to age 5 receive an age-appropriate book mailed directly to their home monthly, building a library of up to 60 books.²³ Books are carefully selected to meet the developmental needs of particular age groups and expose families to a diversity of themes, art, and cultures. Books typically contain reading tips to help the family maximize learning and interaction around the title.²⁴ It has been shown that DPIL participants experience increased frequency of reading at home, greater family engagement and interest around books, and a home literacy environment enhanced by the significant number of books delivered.²⁵⁻²⁸ DPIL participants also show evidence of improved skills directly related to kindergarten readiness, namely letter identification, phonologic awareness,

and letter naming fluency.²⁹⁻³¹

Finally, an urban school district found that DPIL participants scored better on the language and math sections of its validated kindergarten readiness indicator than nonparticipants.³²

Although both programs show promising results, each has relative strengths and weaknesses. ROR delivers reading guidance during the critical early years and reaches children at higher risk for poor kindergarten readiness but only provides a small library over the 5 years of exposure. DPIL provides a significant library but does not routinely give in-person guidance to caregivers. To capitalize the strengths of the individual programs, we piloted a novel ROR and DPIL combination program (ROR/DPIL) administered through the existing ROR structure in our city and sought to assess the effect of this integration on kindergarten readiness.

The Ohio Kindergarten Readiness Assessment (KRA) is administered early in the kindergarten year to students attending Ohio public schools. The KRA is designed to measure academic readiness across four domains: language and literacy, social foundations, mathematics, and physical well-being and motor development.³³ Analysis has revealed that the KRA is a valid predictor of third grade reading achievement. In particular, the language and literacy subtest (KRA literacy) has a strong predictive relationship with future reading achievement. Researchers show that 66% of children on-track in literacy on the KRA pass the third grade reading test, compared with only 33% of children not on-track.³⁴ We hypothesized that children exposed to ROR/DPIL will be more ready for kindergarten, as assessed by KRA literacy scores, compared with those who were not exposed to the combined program. We aimed to compare the KRA literacy on-track rate of sequential ROR/DPIL cohorts and secondarily analyze comparisons

to school district averages, matched cohorts, and low socioeconomic status (SES) matched cohorts.

METHODS

Study Design

We conducted a quasi-experimental intervention study comparing the KRA literacy scores of ROR/DPIL participants attending a Cincinnati Public School (CPS) kindergarten with those of nonparticipant CPS peers. We initiated ROR/DPIL July 2015 and analyzed KRA literacy scores of participants entering kindergarten in 2016, 2017, and 2018. Institutional review board and CPS approval was obtained.

Participants and Setting

We recruited participants at all 23 ROR clinics in Cincinnati. Clinics spanned multiple health care systems, caring for ~15 000 patients 0 to 5 years, with >30 000 ROR visits yearly. Most practices were in urban areas of Cincinnati, served a high proportion of Medicaid patients, and were federally qualified health centers. Beginning July 2015, any patient age <5 visiting a ROR clinic was eligible for participation if they resided in zip codes that encompassed the CPS district. There were no other eligibility requirements.

As of January 2019, active ROR/DPIL enrollment was 10 848. More than 95% of parents approached agreed to participate, with a retention rate of 91% from program enrollment to kindergarten entry. Three cohorts of ROR/DPIL participants were included in the kindergarten assessment. In total, 3247 enrollees were eligible for kindergarten between the school years of 2016–2017, 2017–2018, and 2018–2019. Of these, 797 (25%) ROR/DPIL participants were linked to CPS KRA scores.

Intervention

At all clinics, ROR continued to operate its established standard model. At well-child visits, all children 5 years and under received an age-appropriate book and guidance on shared reading. Although all children received ROR, only children in CPS zip codes were eligible for the intervention and were offered DPIL enrollment as part of the ROR visit. Families enrolled in DPIL and consented to participation by paper form. Parents could choose to enroll in DPIL and receive books but not consent to the evaluation portion of the program. We entered enrollment forms centrally into a study database and the DPIL book order system. Children in DPIL then received a book delivered monthly to the home via mail until their fifth birthday as administered by the national DPIL program. At subsequent clinic visits, providers continued ROR for all patients, and for those in DPIL, confirmed enrollment, captured address changes, and encouraged families to read their DPIL books.

Outcome and Measures

The primary outcome measure was the language and literacy subtest of the KRA. A scaled score >263 indicates a student is “on-track” for kindergarten.

Measure of SES

Aided by the Community Building Institute of Xavier University, we geocoded student residential addresses to determine census tract. We then identified SES quartiles for census tracts as tabulated by Maloney and Auffrey in *The Social Areas of Cincinnati*. This method calculates SES index scores using census tract metrics from the 2005–2009 American Community Survey, which encompasses family income, education level, percentage of unskilled and semiskilled workers, percentage of children living in married-couple, family households,

and percentage of housing units with >1 person per room.³⁵ Index scores were split into quartiles, with the lower quartiles having a higher concentration of families with socioeconomic risk.

Data Analysis

Our analysis included only ROR/DPIL participants who could be accurately matched to a CPS KRA score. We linked CPS KRA results to ROR/DPIL records having documented parental consent using approximate string matching (ie, fuzzy matching).³⁶ Fuzzy matches have the capability to find approximate matches between strings or groups of strings (accounting for subtle spelling differences and special characters) and provide a value that represents the strength of each match. Records were matched on first name, last name, and birth date by using the Fuzzy Lookup add-on tool for Microsoft Excel. Exact matches were automatically included into KRA cohorts. Fuzzy matches were further evaluated by using sex, race, guardian, and address. KRA scores were not included if the assessment was incomplete ($n = 24$) or was a retest for a repeated year of kindergarten ($n = 10$). In the event of a retest, the participant’s original KRA score was selected.

In our primary analysis, we compared KRA literacy performance of ROR/DPIL cohorts entering kindergarten in fall 2016, 2017, and 2018. In our secondary analysis, we compared KRA literacy performance of ROR/DPIL participants to (1) that year’s school district average performance, (2) a 2:1 stratified non-ROR/DPIL matched comparison group of class peers, and (3) a 2:1 stratified comparison with both intervention and comparison restricted to economically disadvantaged children.

For the CPS average, we used KRA literacy scores for all students enrolled in CPS for that academic year as published in the CPS KRA Report.³⁷

This average includes every CPS student and does not exclude children in the intervention group.

We created a proportionate stratified random sample of non-ROR/DPIL students to ensure demographic and socioeconomic characteristics were similar between groups. Three variables (race, SES quartile, KRA year) were combined to create the stratum. Of the 797 ROR/DPIL participants matched to KRA scores, we excluded 7 because of missing data (4 SES, 3 race). We used the stratum proportions for the remaining 790 ROR/DPIL participants to create the proportionate sample of non-ROR/DPIL students ($n = 1580$) from a pool of 7270 CPS records that consisted of all completed KRA scores within CPS from the 2016, 2017, and 2018 school years, excluding the known 797 ROR/DPIL participants. We randomized selections within the stratum. The ratio of non-ROR/DPIL students to ROR/DPIL participants was 2:1. Specifically, for every ROR/DPIL participant, there were 2 non-ROR/DPIL comparisons with identical race, SES quartile, and KRA year. Finally, for the third analysis, both the intervention group and the 2:1 matched comparison group were restricted to members of low SES quartiles 1 and 2.

Descriptive statistics and χ^2 tests were used to evaluate KRA literacy performance (on-track and not on-track) between the three independent KRA cohorts (2016–2017, 2017–2018, and 2018–2019). In addition, Fisher's Exact tests were performed to evaluate differences in KRA literacy status between ROR/DPIL participants and the stratified comparison groups within each cohort.

RESULTS

Study Sample

We matched KRA scores to 25% ($n = 797$) of the 3247 ROR/DPIL children

eligible for kindergarten during the 3 years examined. This included 147 of 388 children (38%) in 2016–2017, 271 of 1179 (23%) in 2017–2018, and 379 of 1680 (23%) in 2018–2019. We were unable to identify KRA scores for the remaining 2450 participants. Demographics of KRA matched ROR/DPIL participants cohorts are summarized in Table 1.

It is important to note that each participant differed in duration of exposure to the DPIL component of ROR/DPIL. All participants were potentially exposed to ROR from birth but were only exposed to DPIL from date of enrollment. Exposure to DPIL was calculated as interval between date of DPIL enrollment and kindergarten entry. Average length of exposure to DPIL was 8.6 months for the 2016–2017 cohort, 16.8 months for the 2017–2018 cohort, and 24.5 months for the 2018–2019

cohort. In Figure 1, we graphically represent program exposure.

Kindergarten Readiness and Program Impact

Cohort Effect

KRA literacy results were evaluated via the percent "on-track" metric (scaled score >263) between three cohorts. The percentage of students on-track differed significantly by cohort (2018–2019, 58.3% [95% confidence interval (CI): 53.3%–63.3%] versus 2017–2018, 50.9% [95% CI: 44.9%–56.9%] versus 2016–2017, 42.9% [95% CI: 34.9%–50.9%], $\chi^2 [2, n = 797] = 10.83, P = .004, \Phi_c$ [Cramer's V measure] = 0.12). The results represent a difference of 8 percentage points between cohorts 1 and 2 ($P = .125$, Fisher's exact test), 7.4 percentage points between cohorts 2 and 3 ($P = .066$, Fisher's exact test), and 15.4 percentage points between

TABLE 1 Demographic and Enrollment Characteristics of ROR/DPIL Graduates in CPS Kindergarten Classrooms

Variable	2016–2017 ($n = 147$)		2017–2018 ($n = 271$)		2018–2019 ($n = 379$)		Total ($n = 797$)	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Sex								
Female	85	57.8	130	48.0	177	46.7	392	49.2
Male	62	42.2	141	52.0	202	53.3	405	50.8
Race								
Black or African American	109	74.1	199	73.4	301	79.4	609	76.4
White	10	6.8	19	7.0	32	8.4	61	7.7
Hispanic	16	10.9	23	8.5	14	3.7	53	6.6
Other or multiracial	12	8.2	30	11.1	32	8.4	74	9.3
SES quartile								
SES 1	68	46.3	109	40.2	133	35.1	310	38.9
SES 2	41	27.9	82	30.3	121	31.9	244	30.6
SES 3	31	21.1	55	20.3	93	24.5	179	22.5
SES 4	5	3.4	24	8.9	31	8.2	60	7.5
SES unknown ^a	2	1.4	1	0.4	1	0.3	4	0.5
Length of exposure								
<1 y	64	43.5	36	13.3	17	4.5	391	49.1
1 y	25	17.0	215	79.3	151	39.8	226	28.4
2 or more years	1	0.7	15	5.5	210	55.4	117	14.7
Could not be determined ^b	57	38.8	5	1.8	1	0.3	63	7.9

χ^2 analyses were used to compare differences in sex, race, and SES quartile by cohort year. Results were nonsignificant for sex ($\chi^2 [2, n = 797] = 5.48, P = .064$) and SES quartile ($\chi^2 [6, n = 793] = 9.78, P = .134$), but race differed significantly by cohort ($\chi^2 [6, n = 797] = 13.19, P = .040, \Phi_c = 0.09$). Post hoc analyses indicated that race in the 2018–2019 cohort differed significantly from the 2016–2017 ($\chi^2 [3, n = 526] = 10.35, P = .016, \Phi_c = 0.14$) and 2017–2018 ($\chi^2 [3, n = 650] = 8.67, P = .034, \Phi_c = 0.12$) cohorts because of variability in the Hispanic population from year to year.

^a SES quartiles could not be determined by the Community Building Institute of Xavier University for individuals with incorrect or missing home addresses.

^b Length of Exposure was calculated on the basis of date of enrollment into DPIL. Data were not available for all participants.

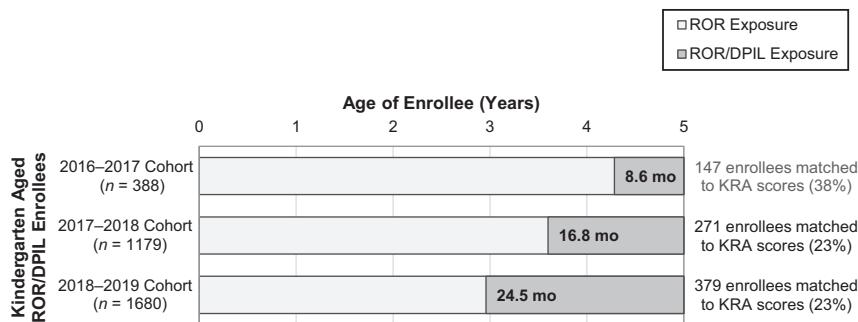


FIGURE 1
ROR/DPIL exposure by cohort.

cohorts 1 and 3 ($P = .002$, Fisher's exact test).

Comparison With CPS Averages

The percent of ROR/DPIL participants on-track in literacy was compared with the overall CPS district percentages for each respective cohort year.³⁷ As seen in Fig 2, deltas (Δ) indicate the difference between district and ROR/DPIL results. District percentages do not exclude

ROR/DPIL participants. On-track percentages on KRA literacy for the district were consistently higher than those of ROR/DPIL; however, the difference was smaller for each subsequent cohort (14.8%, 7.9%, and 3.2%, respectively).

Comparison With Stratified Comparison Group

Demographics of ROR/DPIL and non-ROR/DPIL stratified group samples are summarized in Table 2. The

results for ROR/DPIL participants who were on-track in literacy versus the comparison group within each cohort year are illustrated in Figure 3. Differences between groups are indicated as deltas (Δ). On-track percentages for the comparison group exceeded ROR/DPIL participants by 6.2 percentage points in 2016-2017 and 1.9 percentage points in 2017-2018. In 2018-2019, ROR/DPIL participants were on-track more frequently than the comparison group by 1.6 percentage points. Fisher's Exact tests (Bonferroni adjusted $\alpha = .0167$) did not indicate significant differences between groups for any of the cohort years ($P = .262$, $P = .653$, and $P = .656$, respectively).

Comparison of Low SES ROR/DPIL Participants and Low SES Stratified Comparisons

In total, 551 participants remained in the low SES 1 and 2 quartiles for the ROR/DPIL group, and 1102 remained in the low SES quartiles for the comparison group. The racial breakdown of both groups was 80.8% Black or African American, 7.3% Hispanic, 6.0% white, 5.3% multiracial, and 0.7% Asian; the SES breakdown was 55.7% SES 1 and 44.3% SES 2; and the test year breakdown was 19.8% for 2016-2017, 34.1% for 2017-2018, and 46.1% for 2018-2019. Sex remained similar between groups (ROR/DPIL [52.1% male, 47.9% female] versus comparison [52.9% male, 47.1% female]). The ROR/DPIL participants outperformed the comparison group by 1.9 percentage points in 2017-2018 and 5.3 in 2018-2019 (Fig 3). Fisher's exact tests (Bonferroni adjusted $\alpha = .0167$) did not indicate significant differences between groups for any of the cohort years ($P = .191$, $P = .721$, and $P = .191$, respectively). In Figure 4, we illustrate the low SES comparison in the context of district performance.

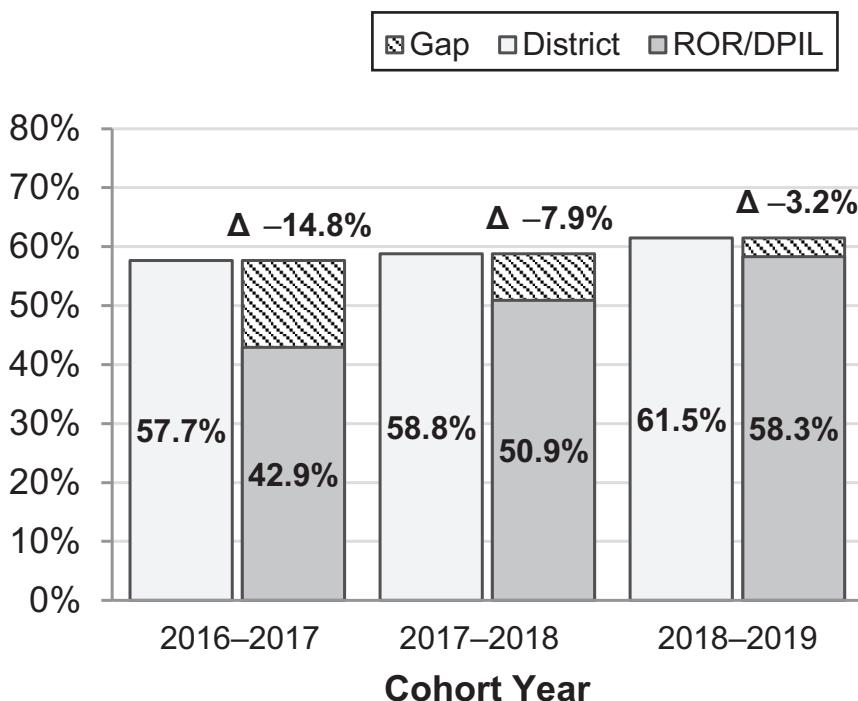


FIGURE 2
Percentage of ROR/DPIL participants on-track in KRA literacy versus CPS district comparison. District results do not exclude ROR/DPIL participants. District samples sizes for years 2016-2017, 2017-2018, and 2018-2019 were 2690, 2659, and 2718, respectively.

TABLE 2 Demographic Characteristics of ROR/DPIL Graduates, a Stratified Comparison Group of Non-ROR/DPIL Participating Kindergarteners, and the Total CPS District KRA Cohort

Variable	ROR/DPIL Graduates Matched to Stratified Comparison Group ^a	Non-ROR/DPIL Stratified Comparison Group ^b	Total CPS District KRA Cohort ^c
	n (%)	n (%)	n (%)
Sex			
Female	388 (49.1)	774 (49.0)	3893 (48.3)
Male	402 (50.9)	806 (51.0)	4174 (51.7)
Race			
Black or African American	611 (77.3)	1222 (77.3)	4856 (60.2)
White	61 (7.7)	122 (7.7)	1956 (24.2)
Hispanic	55 (7.0)	110 (7.0)	469 (5.8)
Other or multiracial	63 (8.0)	126 (8.0)	786 (9.7)
KRA test year			
2016–2017	145 (18.4)	290 (18.4)	2690 (33.3)
2017–2018	267 (33.8)	534 (33.8)	2659 (33.0)
2018–2019	378 (47.8)	756 (47.8)	2718 (33.7)
SES quartile			
SES 1	307 (38.9)	614 (38.9)	2364 (29.3)
SES 2	244 (30.9)	488 (30.9)	2213 (27.4)
SES 3	179 (22.7)	358 (22.7)	2027 (25.1)
SES 4	60 (7.6)	120 (7.6)	1394 (17.3)
SES unknown	0 (0.0)	0 (0.0)	69 (0.9)

^a n = 790.

^b n = 1580.

^c n = 8067; aggregate of 2016–2017, 2017–2018, and 2018–2019 CPS KRA cohorts.

DISCUSSION

In this study, we sought to examine the effect of a novel combined ROR/DPIL program on kindergarten readiness as measured by the KRA literacy. Findings supported the potential long-term benefits of participation in ROR/DPIL. We found a significant difference in performance on the KRA literacy between cohorts 2016–2017,

2017–2018, and 2018–2019. ROR/DPIL cohorts improved the on-track rate on the KRA literacy by 15.4% between the first kindergarten cohort of 2016–2017 and the third kindergarten cohort of 2018–2019, the incremental yearly increase suggesting a dose effect, whereas the school district increased by 3.8%. In the second comparison, ROR/DPIL cohorts improved by 16.1%, whereas

the stratified 2:1 comparison group increased by 8.3%. When restricted to the lower SES 1 and 2 groups, ROR/DPIL participants increased the on-track rate in literacy on the KRA by 19.7%, whereas the comparison group increased by 6.6%.

In all three cohort comparisons, the initial 2016–2017 ROR/DPIL cohort lagged behind the district comparison in the on-track rate on the KRA literacy; however, participation in ROR/DPIL suggested a closing of that literacy gap during the 3 years of this evaluation. The 2016–2017 ROR/DPIL cohort lagged the district comparison by 14.8%, whereas the 2018–2019 ROR/DPIL cohort was only 3.2% lower on-track in literacy. In the remaining two comparisons, the ROR/DPIL cohort outperformed the comparisons in the third year. The 2016–2017 ROR/DPIL cohort lagged the 2:1 stratified comparison by 6.2% but in 2018–2019 ROR/DPIL outperformed by 1.6%. Especially notable, the 2016–2017 ROR/DPIL cohort lagged the low SES stratified comparison by 7.8% but outperformed the comparison by 5.3% in 2018–2019. This early result is encouraging by suggesting a significant effect on the at-risk population.

The ROR/DPIL pilot also revealed promise in operational success. During a 42-month period, ROR/DPIL practices enrolled 14 799 children in DPIL and provided reading guidance during >90 000 ROR visits. More than 320 000 books were distributed to homes. Geocoding revealed most program enrollees lived in areas of high poverty. ROR/DPIL illustrated that pediatric health care providers are an effective way to reach a large number of children and deploy interventions touching the important early years of development.^{38,39} Additionally, because most ROR practices reach a high percentage of underserved patients, combining DPIL, or other programs, with ROR has the potential to greatly enhance

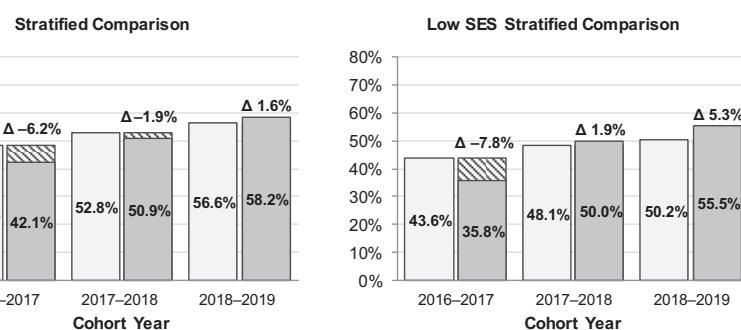


FIGURE 3

Percentage of ROR/DPIL participants on-track in KRA literacy versus stratified comparison groups.

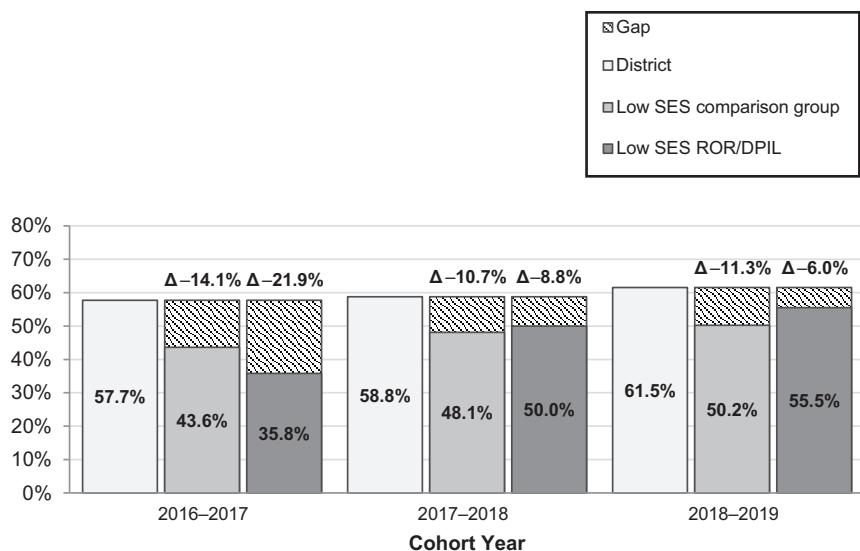


FIGURE 4

Percentage of low SES ROR/DPIL participants and low SES stratified comparison group on-track in KRA literacy versus CPS district.

enrollment of vulnerable populations. This pilot revealed that this model can be successfully implemented and, using a ROR structure that exists similarly in other regions, shows potential for successful spread. Previous researchers have shown that ROR anticipatory guidance is critical and, when associated with other literacy resources, has an augmented effect on the home literacy environment.⁴⁰ Marrying a literacy program traditionally in the pediatric medical realm (ROR) with one that is not (DPIL) was an operational success that was able to reach a large number of children in need with potentially amplified effects.

Although highly encouraging, the results of this analysis need to be interpreted with appropriate context. First, we could not control for exposure to other programs promoting kindergarten readiness or for preschool participation, although there was no other known widespread programming. Similarly, the cause of improvement in comparison groups is unknown. Regarding our program, unmatched ROR/DPIL participants could be included in comparison groups, or

a change in the local literacy environment, resulting from the flood of books into the community, could have impacted even nonenrolled children, both factors potentially reducing the measured impact of ROR/DPIL. Finally, we are unable to identify exact causes for KRA literacy improvement in ROR/DPIL participants. There are several possibilities based on program design: more books in the home, more motivation to read, and more reminders to read. Furthermore, we cannot draw conclusions on the exact impact of each individual program. Although ROR had been in operation and the change was the addition of DPIL, it is unknown how much program effect was due to DPIL, ROR, or synergy between the two programs.

Additionally, the number of participants matched to a CPS KRA score was significantly lower than the total number of enrollees. This is explained by multiple factors. First, school district boundaries do not conform to zip codes, so some enrollees, who were recruited by zip code, did not live within the CPS district. Second, some enrollment

forms had incomplete consents, so scores were unattainable. Third, children within the CPS district can choose to attend an alternative private or charter school. Fourth, the population enrolled tends to be highly mobile, resulting in enrollees frequently moving out of the CPS district. Finally, accurately matching to KRA scores was difficult. We erred on the side of more accurate matching, so differences in names used to enroll in ROR/DPIL versus CPS could result in no match.

Despite its limitations, this study provides evidence that programs such as ROR and DPIL can be effectively deployed using pediatric health care providers on a scale capable of influencing the health and development of children at a population level. Key strengths of this study include the solid trend in improvement in the on-track rate on the KRA literacy for ROR/DPIL groups, and, because of a strong matching procedure, we are confident that the scores included in the analysis for the ROR/DPIL cohorts are participants. This is the first investigation into this combined program and the positive effects observed warrant further investigation into the extent and mechanism of impact on kindergarten readiness.

CONCLUSIONS

Participants in the ROR/DPIL program, which combined repeated guidance on sharing books at preschool well-child visits with a sustained influx of books in the home, significantly improved performance on the KRA literacy of entering kindergarteners over the 3 years of the program. The gap in kindergarten readiness of program participants compared with the overall school district results was closed in the 3 years of this program.

Both the ROR and DPIL have evidence of effectiveness in promoting literacy

in preschoolers. With this early study, we suggest that when combined and sustained, these two programs have the potential for effectively supporting the development of preliteracy skills of large populations of at-risk children, improving kindergarten readiness, and, ultimately, success in school and life. Primary care practices are positioned to influence the literacy developmental trajectory of children long before they are served by other educational services. The integration of early childhood literacy promotion programs, such as ROR and DPIL, as a routine part of primary care

gives pediatric health care providers tools to make a significant difference in the lives of their patients and should be considered an element of standard care.

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ABBREVIATIONS

Φc: Cramer's V measure
CI: confidence interval
CPS: Cincinnati Public Schools
DPIL: Dolly Parton's Imagination Library
KRA: Kindergarten Readiness Assessment
ROR: Reach Out and Read
SES: socioeconomic status

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